TECHNOLOGY

approach

NAVAER 00-75-510

JUNE 1960

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GET THE WHOLE PICTURE—The rule says "step back far enough to see the whole picture," but sometimes this doesn't work. If we step back too far from a problem, it begins to get small—sometimes too small to worry about. Sometimes we have to move in closer to "get the whole picture," so that we may see a problem in sufficient detail. In aviation safety we must often examine our problem from both viewpoints, near and far, for only after we have seen it in both aspects do we Get The Whole Picture . . .

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APPROACH

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LETTERS

For Flight Plan Item

Sir:

We are concerned about the lack of a regulation (3720.2A) requiring a pilot filing an IFR Flight Plan to obtain a forecast altimeter setting for destination and alternate. VMT-1 requires it as a matter of SOP, as does the Air Force. Without it enroute radio failure could prove embarrassing, if not FATAL.

C. L. COMFORT, CAPT, USMC

VMT-1, Cherry Point

Head Lights & Night Vision

Sir:

In tinkering with a solution to the problem of "Head Lights and Night Vision" we have found that a layer of zinc chromate on the head lights of autos and support vehicles, which operate on or near the flight line is far superior to the practice of masking off the lights . . . It has such merit as to warrant Navy-wide dissemination.

W. E. WILLIAMS, LCDR

CVG-12, Miramar

Helmet Wear

Sir:

After pulling the chocks from the nose wheel of an F4D the plane captain straightened up and immediately lost his flight deck helmet into the left intake of the aircraft. The engine was idling at 66%. Luckily the helmet lodged against the upper duct support rods and the engine was shut down without damage.

The helmet was worn without the chin strap connected. The steel band for the sound attenuating ear cups was broken—all contributing to a loose fit. Examination of unit flight line gear disclosed four other helmets with broken head bands. Since this equipment is subject to considerable wear and tear in daily use it should be inspected frequently and replaced as necessary. The chin strap should be fastened when the helmet is worn.

J. T. RYAN, MAJOR, USMC

VMF(AW)-513, El Toro

'Survivor Sighted'

Sir:

Relative to using the landing gear as a signal to a downed pilot: VMT-1's signal to a downed pilot that you have *lost* sight of him is *lowering* the landing gear. A clean orbit while you have a downed pilot in sight increases your time on station available. The training command uses the opposite signal and, for the F9F, it is probably the best. We suggest that standard be adopted for joint usage through the services.

ASO, VMT-1

● See next letter.

'Survivor Sighted'

Sir:

I have read with interest in the March issue a letter submitted by Cdr. O. W. Siler, titled "Survivor Sighted."

Cdr. Siler stated that jet aircraft of the Corpus Christi area, while circling a downed pilot, lower the gear as long as the pilot is in sight.

Due to extremely high fuel consumption of jet aircraft orbiting at low altitudes with gear extended, it is recommended that as standard practice, the circling aircraft remain clean (gear up) and orbit in a left-hand circle while the downed pilot is in sight.

Should contact with the downed pilot be lost, the circling pilot will then *reverse* orbit to a right-hand circle indicating to the downed pilot he is no longer under observation.

H. J. TATE, CDR

NAATC Corpus Christi

► Thanks for the comment and additional suggestion. You'll note that in the answer on page 19 (March '60 APPROACH) we did refer to the high fuel consumption problem of turbine powered aircraft.

Chopping Out

Sir:

A transition student was completely strapped aboard one of our F9F-8T aircraft and an unserviceable canopy closed over his head. He was shown the proper way to hold the survival knife then given the "go" signal to commence chopping his way through the canopy. He was out in three minutes and 20 seconds, while breathing 100% oxygen.

Time was lost by the pilot striking initial blows at the canopy while he was still strapped in. Unstrapping prior to striking initial blows would have enabled the pilot to strike harder blows and, of course, been less tiring. After the first hole was opened the upper portion of the 8T canopy became so flexible that further attempts in that area were ineffective. Attempts to break the canopy by bumping with his head were futile. He succeeded in opening a large

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hole on the left-hand side of the canopy. The pilot attempted to leave the cockpit via this hole prior to disconnecting his oxygen supply hose, bailout bottle, and headset. After reentering and disconnecting he was able to leave the aircraft.

By using the rear portion of the canopy (rear seat area) we demonstrated the advantage of scribing a hole prior to striking the first blow. This makes it much easier to break out. Further, because of the limited area in the front seat of Martin-Baker equipped aircraft, we recommend attempting to break out at the side, adjacent to the canopy rail, where the canopy is more rigid.

C. L. COMFORT, CAPT, USMC
VMT-1, Cherry Point

Altimeter Check

Sir:

Noticed in USAF safety magazine a recommendation to use cockpit cabin pressure altitude to cross-check altimeter reading. It, of course, is not accurate for pressure altitude but it is good enough to prevent mistaking 20,000′ for 10,000′ or 30,000′ . . . Think it is well worth passing on to naval aviation as an optional SOP for jets.

T. F. TAVEMETH, CDR
CFAJ—NPO 3835

'Eagle Eye'

Sir:

In perusing the March 1960 issue of APPROACH the first item to come to my attention was Anymouse's letter about Murphy's Law. What law covers "goofs" in the captioning of photos?

On page 21, under the photo of AD wreckage, the caption reads "During a second attempted GCA *wheather* deteriorated an indefinite zero with ⅛ of a mile visibility." New words and a new form of interpretive grammar?

Could this be construed as "Moiphy's Lawr of Slaughtered English"?

ANONYMOUS

● **Aye! Judging from the many reports on this one APPROACH is read (also the faces of the editors red!)**

Wanted: Photos Galore

We want to illustrate the APPROACH with the best photographs that we can obtain. Frequently the best pictures of aircraft, naval flight operations, and readyroom and maintenance situations are to be found in cruise books.

Usually the original photographs are discarded after they have been used by the cruise-book printer. If they could be sent to the Naval Aviation Safety Center, they would be sorted, entered in our permanent files, and be available when appropriate for illustrating safety literature. Credit will be given where possible. Cooperation on the part of cruise book editors will be greatly appreciated. Please forward photos to Commander, NASC, Attn: APPROACH, NAS, Norfolk 11, Va.

Anti-Collision Light Usage

Sir:

I was very interested in your answer regarding anti-collision lights. Being in a MATS squadron, operating under Air Force regs I am taking the liberty and forwarding the portion of AFR-60-16, para. (15) that pertains to "When Lights Will be Used."

I do not agree however with tower personnel in regards to the use of the anti-collision lights at night on the ground. The possibility exists that emergency equipment, such as crash equipment, ambulances, and other type emergency equipment could and would lead to much confusion on a field at night, when their emergency red flashing lights are in use.

AFR 60-16 para. 15 When lights will be used.

A. During the period 30 minutes before sunset until 30 minutes after sunrise or anytime when flight or prevailing ground visibility is less than three miles, aircraft in flight or operating on the ground, or if stationary and likely to cause a hazard, will show standard position lights.

B. When installed, the anti-collision lights will be used at all times during flight. It may be turned off during flight through clouds when the rotating light beams reflect into the cockpit and constitute a hazard to safe operation of the aircraft.

C. Position lights will be STEADY when used in conjunction with the anti-collision light. When not used in conjunction with the anti-collision light, they will be FLASHING.

D. Formation flights are exempt from B and C above.

F. G. CHASE, CDR
VR-8

Foam Signal

Sir:

Recently I found myself faced with the problem of making a landing with the nose gear still hung up in the wheel well and both main gears extended. I had lost radio contact with the tower and entered the break rocking my wings. I could not recall any air to ground signal by which I could notify the crash crew that I required the runway foamed. After 3 waveoff approaches the crash crew foamed the runway thus solving my problem. There are many possible signals which could be adopted such as—fish-tailing into the break or on the downwind leg or while taking a waveoff. I strongly urge that steps be taken to adopt some such signal and put it into effect as soon as possible.

D. E. NICHOLS, LT
NAAS Saufley Field

Security Classification of Aviation Safety Material

Sir:

For the third time in one year, I have seen important messages, correspondence and other "pass the word" media on aviation safety come through with a Confidential classification. In each case, the subject matter was information that should be given immediate attention with possible corrective action down on the Mechanic/NCO level.

Overclassification is a hindrance that we in aviation safety can ill afford as it is a known fact that assignment of security classification prevents thorough dissemination of information. In order to make every pilot, supervisor, NCO and mechanic safety-conscious, we must continually furnish them with intelligent, convincing material to inspire their utmost attention to duty . . .

SAFETY OFFICER

Pity the poor bushed pilot! Flight fatigue unquestionably represents a substantial aero-medical problem. How well we can come to understand it and to handle it will determine our future performance record—and our safety record. Pity the poor bushed pilot . . .

BUSHED PILOT

By LT R. L. Brisbin, MC, USNR

FATIGUE, literally meaning to "waste away," is a universal experience among human beings to some degree or another. Because of its universal nature and its usual lack of serious consequences, except in extreme form, we ordinarily do not pay much attention to it; however, even in small amounts, it is of paramount importance to aviation safety and is probably one of the most critical problems in modern aviation medicine.

One of the main reasons for this is that while we have made great strides in developing aircraft with increasing long range, higher performance, and greater technical complexity, we have not paralleled these strides in the understanding of our human machines. So we must examine closely what is known about human fatigue, attempt to apply it to our own operation, and then actively prevent it wherever and whenever possible.

Fatigue means many things to many people. To the physiologist it may mean the failure of a tissue to respond after repeated stimulation; to the metallurgist or engineer it may mean the failure of metal in a structural member or moving part following long use (or abuse). To us in aviation it may be best defined as: *a stress, primarily dependent only on the sheer duration of an activity, augmented by physical or purely psychic and emotional stresses.*

There are three major types of human fatigue with which we are concerned: physical fatigue, chronic fatigue, and skill or static fatigue. While I shall discuss these separately at first, I wish to emphasize at the outset that they are all interrelated and are found usually in combination rather than singly in a given individual in flight. I further wish to emphasize that the presence of any one of them may hasten the appearance of the others.

Pure Types of Fatigue

Physical fatigue is that healthy, normal, muscular, and mental weariness following strenuous exercise or excitement. It is largely physiologic in nature with relatively little psychologic component. It usually produces stimulation of the appetite and is quite conducive to relaxation. It also serves ordinarily as a warning sign that physical exertion should be discontinued so that body energy reserves may be restored. It is completely relieved by normal sleep, muscular rest, and freedom from excitement.

Chronic cumulative fatigue is mainly psychologic in nature. It results from the continuous strain of adjusting to stressful occupational demands, often augmented by fears of death, maiming, of "Letting the outfit down." It has been shown that all men can develop this type of fatigue if the amount and duration of stress are sufficient. The reason that some men develop it (in a given operation) where others do not is because of individual differences in psychologic background, personality development, and ability to adjust to stress. If not recognized and treated at its outset it may culminate eventually in the severe psychoneurosis known as "combat fatigue," (actually a misnomer because true combat need not be involved). The predominant symptoms of this type of fatigue in pure form are: (1) tense feelings; (2) irritability; (3) frustration; (4) lassitude; (5) loss of confidence; (6) greater awareness of body discomfort; (7) depression; (8) insomnia; (9) anorexia (loss of appetite); and (10) forgetfulness.

The last pure form of fatigue which is seen is static or skill fatigue. It is this type of fatigue which forms the largest segment of flying fatigue and is also the most dangerous from the standpoint of aviation safety. It occurs in aviation personnel even in the presence of an outstanding physical condition and above average psychologic stability. Its main causes are common in all flying to some degree, and are: (1) boredom; (2) prolonged concentration; (3) attention to details, especially when associated with responsibility; (4) physical discomfort, i.e., sitting in one place for prolonged periods; (5) need for constant alertness; (6) mild hypoxia (oxygen lack); (7) noise; and (8) vibration.

The reason why static fatigue is so dangerous is because of its insidious onset, its marked, if transient, effect on mental processes rather than physiologic ones, and because the subjective sensations of fatigue are the last to appear and warn

the subject. It leads to unrecognized little mistakes, which all too often can turn (and have turned) into big accidents. The effect of static fatigue may be best summed up as those of carelessness, complacency, and a progressive unconscious lowering of performance standards and motivation all out of proportion to any actual decreased capacity to perform or physiologic inadequacy. In many cases, the subject actually thinks he is performing better than usual.

Controlled studies have shown the following to be the most important examples of performance or output decrement seen with static fatigue; (1) need for larger than usual stimuli to call forth an appropriate response; (2) errors of timing in performing tasks comprising more than one action; (3) overlooking of important elements in a given task sequence; (4) loss of accuracy and smoothness in control column movements leading to overcontrolling and jerkiness; (5) unawareness of even gross errors in heading, altitude, attitude, and increasing susceptibility to vertigo; (6) greater unreliability of reports of what transpired during a given time; (7) inattention, or concentration of attention to the center of vision with resultant neglect of the peripheral fields; a tendency to fix on one instrument rather than to scan all instruments.

Flight Fatigue

All three pure types of fatigue are interdependent and combined to varying degrees in any flying situation so that we may now speak of "flight fatigue" as a separate entity with magnitudes of the three pure types. The occasions for the production of flight fatigue are almost endless and reach their peak on long routine overwater

flights, especially when flying on instruments or at night. Flight fatigue rarely lends itself to measurement in the field. Any physiologic responses or tissue impairments clearly referable to flying for long periods have, to the present, largely eluded detection. So most cases of flight fatigue, as we encounter them, will consist either of objective evidence of poor professional performance (including accidents) or of subjective experience by the individual airman and his purely subjective complaints of fatigue.

Now let us revert to the principle that some flight fatigue can be shown to exist before it is actually experienced and examine some of the known major determinants of flight fatigue and see what, if anything, we can do to combat them:

Psychologic and Emotional Stress. Under this heading comes such things as boredom and monotony, responsibility, continued alertness and attention, immobility, mental activity in regard to performing one's duties, and fear. It is impossible for any flight to be completely devoid of such stresses. They are inherent occupational hazards. Many things can be done by the individual, however, to minimize their effects. For one thing, it has been shown that merely to understand the existence of these stresses and to be consciously on guard against their effects will go a long way toward reducing the fatigue that they cause. Fear or anxiety, especially in respect to potential emergency situations, can be eliminated largely by thorough preplanning and rehearsal. This serves to develop overlearning and increases self-confidence.

Immobility. The need to guard against too much immobility also has its physical implications. Considerable muscular work is involved in just sitting and flying. A static type of muscle tension, especially in the postural muscles, can be quite marked. In addition, there is often interference with circulation to certain groups of muscles due to seat pressures. This leads to muscular pains, further muscle tension, and so on.

Physical Discomfort. No military aircraft has ever been built, nor is one likely ever to be built, in which some degree of physical discomfort did not exist for the crew. Discomfort exists no matter where in the airplane one sits for long periods of time. While the construction of an aircraft obviously cannot be changed, certain other causal factors in this physical discomfort can be.

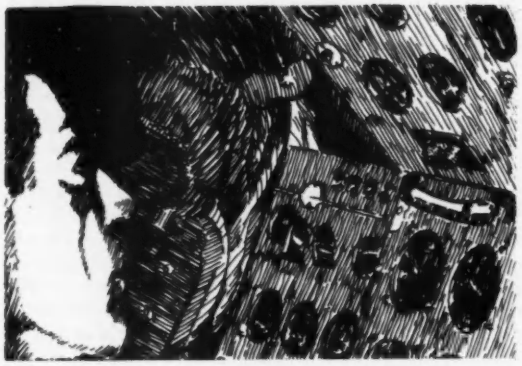
Noise and Vibration. This is a frequently overlooked cause of flight fatigue, perhaps because it is so common and we are so used to it (we think). It also may actually have a hypnotic effect in certain individuals when exposed for long periods. Little can be done to eliminate the source of it in an airplane in flight, but there is strong evidence that the wearing of ear plugs, at least when not on watch, can cut noise to where it is not nearly so fatiguing. Ear plugs are available and all medical officers and aviation medicine technician

corpsmen are competent to fit them. They may be obtained by any pilot or aircrewman who would like to try them.

Hypoxia. This well established cause of flight fatigue, plus decreased night vision, increased susceptibility to vertigo, . . . is probably not too important in WV-2 aircraft inasmuch as cabin altitude rarely gets above 3000 feet; however, even being at 3000 feet for long periods plus heavy cigaret and cigar smoking could conceivably enhance flight fatigue. Of course, wide variations in susceptibility to this mild degree of hypoxia can be expected so that insistence on the use of oxygen on the barrier under normal conditions probably is not warranted. I would recommend that pilots and flight engineers, if they experience subjective fatigue in flight, try breathing 100% oxygen for 5 to 10 minutes out of each hour for whatever beneficial effect it might have. Naturally, rigid oxygen discipline whenever cabin pressurization is lost should be insisted upon and periodically reviewed by all pilots and flight engineers especially.

In-Flight Feeding. We all know how important proper food intake is from the biologic standpoint, but other and most important values of food, especially in flight, are emotional and social, and we must be aware of these too. Improper food intake, especially when associated with the other determinants of fatigue, can have a markedly adverse effect on flying safety. This is because flying for long periods tends to deplete the body's physiologic reserves, especially sugar, and these reserves must be kept intact for best performance to occur. From an emotional point of view, the aircraft environment may adversely affect the palatability of food and the desire for it, and may thereby create dietary dissatisfactions which lead to improper food intake, regardless of the nutritional and caloric adequacy of the food which is available. In addition, the emotional value of food is very important on extended flights to enhance morale, relieve tension, ease boredom, and counteract stress.

In general, emphasis should be placed on the serving of protein rich foods, such as meat, milk, eggs and cheese because these foods create more prolonged, if more slowly developing, high levels of blood sugar; however, high sugar content foods, such as candy, cookies and various pastries should be readily available on all flights not only for their almost universal taste appeal and because utensils are not necessary to prepare and consume them aboard the aircraft, but also because of the rapidity with which their energy content is available—this constitutes the well known "sugar whip" con-



cept. Smaller and more frequent meals are less likely to cause fatigue and drowsiness than large heavy meals.

Morale and Motivation. Morale properly belongs under the heading of psychologic stress, but is so important as a determinant of fatigue as to warrant special consideration. An airman's morale and motivation are key factors in his resistance to fatigue. This is true both as regards individual morale and group morale. Morale and motivation are not rigid quantities which either are there or not. They can be changed in an individual or a group either for the better or for the worse. Where motivation and morale are lacking they may be improved by clarifying goals and keeping personnel informed of progress toward those goals; by the use of various awards and privileges in return for good performance; by maintaining group morale at high levels by every reasonable means; by providing variety and change where monotony tends to exist, et cetera.

Dehydration. The subject of dehydration, which has been shown to contribute to flight fatigue and discomfort, properly belongs here. The usual conditions of temperature and relative humidity to which personnel are exposed for long periods in our aircraft can easily lead to dehydration and, unfortunately, the degree of a man's thirst does not always parallel his fluid needs. The use of coffee alone to replace lost fluids will not work since coffee acts as a mild diuretic and actually will cause a negative fluid balance to develop. The drinking fluids taken aloft should always be readily accessible, widely varied, and highly acceptable, and I recommend that one cup of some other fluid be consumed for every two or three cups of coffee. An excellent hot drink substitute for coffee is instant hot chocolate which can be obtained in

single service packets and has the added advantage of its high sugar content.

Between Flight Preventive Measures

To recognize and prevent fatigue which occurs in flight is only a halfway measure if the pilot or crewman turns to at preflight time with any backlog of fatigue from previous flights or from on-deck activities. The responsibility for preventing such a backlog is two-fold—that of the individual airman and that of command.

The individual's job is mainly to maintain himself in the best possible physical and mental condition with the help of his family, friends and flight surgeon. Good habits should be cultivated so that meals are properly balanced in quality and quantity. All aviators know that they are supposed to eat a good breakfast, but what many aviators forget is that breakfast for them is any meal just prior to beginning the day's work whether this be at 0600, 1500, 2400. . . . The practice of substituting doughnuts and coffee, or a peanut butter sandwich . . . for a more well balanced meal prior to flying is to be condemned soundly.

Sleep and relaxation between flights is critical. All of us differ in our need of sleep, but at least 8 hours of sound refreshing sleep in each 24 hours is probably the minimum that we need to be at peak performance. Even a slight reduction in the amount of sleep (e.g. 25 to 50 percent) can induce significant mental impairment without any subjective feelings or physical clues. Every attempt should be made to sleep or at least to nap just prior to going out for preflight because the longer the interval from awakening to starting a task, the greater the fatigue potential that exists.

Moderation in the use of alcohol and tobacco is axiomatic for the prevention of in-flight fatigue.

Impairment from the use of alcohol, again, is all out of proportion to how a person feels subjectively. The existing rule of abstinence from beer and liquor for at least 12 hours prior to takeoff is an excellent one. It should be enforced rigidly by all plane commanders for themselves as well as for their crews.

Since an airman's occupation is largely sedentary, he requires a moderate amount of intelligently planned physical exercise for the maintenance of peak physical condition and fatigue resistance; however, I recommend that a good night's sleep intervene between any physical recreation and flying lest a backlog of fatigue be taken aloft.

Summary and Conclusions

We have seen how, because of its very nature, flying must always be fatiguing to some degree, but not necessarily to the point of hazard and inefficiency if (1) we can produce a vigorous effort at all levels for the prevention and elimination of those things which tend to produce a backlog and accumulation of fatigue, and (2) we can conduct an educational program directed at reducing to a minimum the determinants and effects of fatigue secondary to flying.

This report has been prepared using most of the available reliable literature on the subject of flight fatigue plus many personal observations made during barrier flying. It is by no means complete. We have much to learn on the subject of flight fatigue and it is hoped that, by continuing observations in our own operation, plus using the observations of others in aviation medicine and aviation safety, we will be able to supplement substantially what has already been said in this report.—*USN "Medical News Letter," No. 12, Vol. 34.* ●

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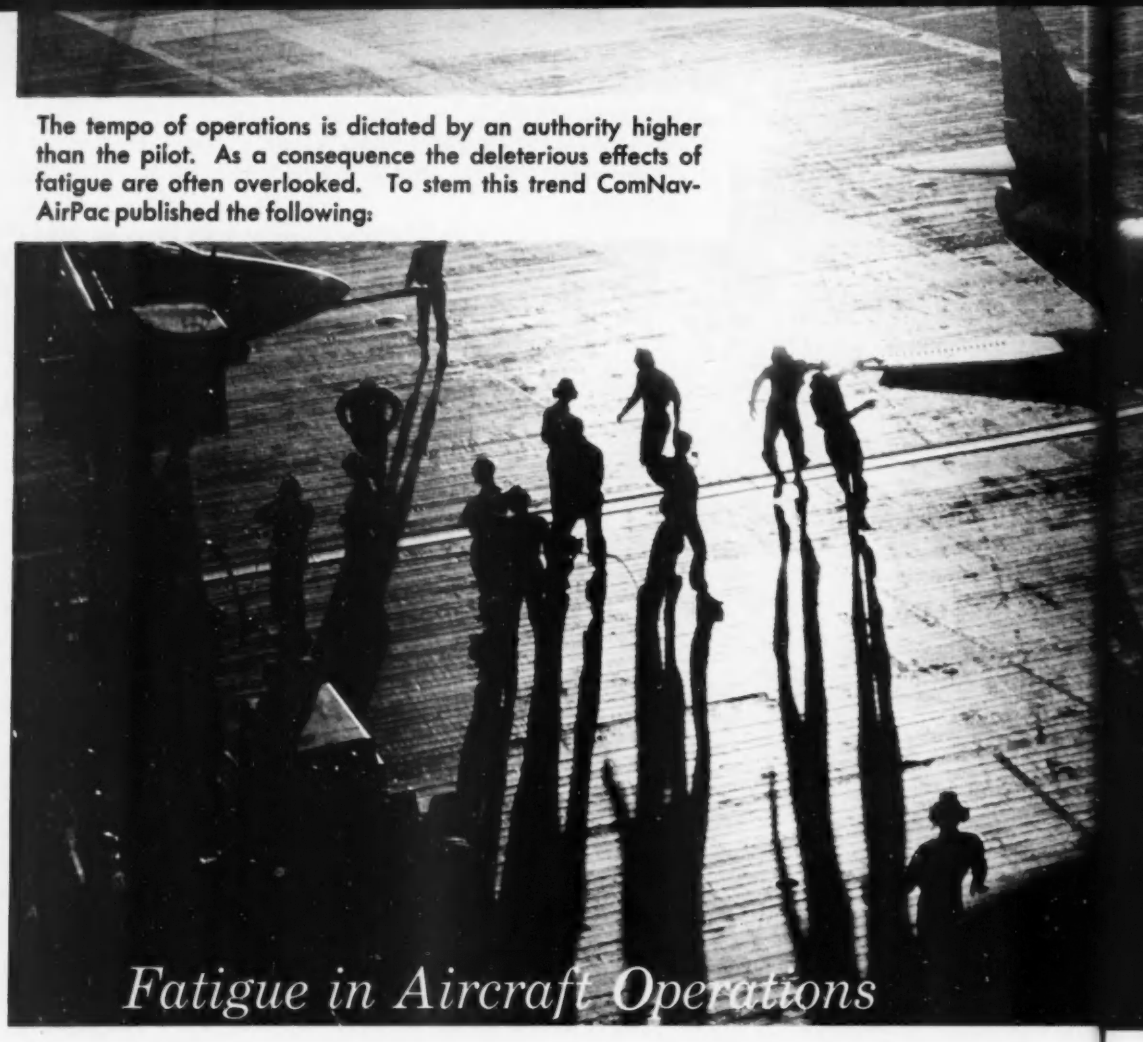
The tempo of operations is dictated by an authority higher than the pilot. As a consequence the deleterious effects of fatigue are often overlooked. To stem this trend ComNavAirPac published the following:



Fatigue in Aircraft Operations

PROBABLY the most frequently complained of, but least understood stress of all, is fatigue.

The problem of fatigue in aircraft operations has become one of the most critical of the unsolved problems in aviation medicine. The deleterious effects of fatigue are suspect in a large number of aircraft accidents, yet there is little factual evidence to support the assignment of fatigue as a primary factor in any accident. There is reason to believe, however, that the modern aircraft, with infinitely higher performance characteristics, now subjects the aircrew to a generally more fatiguing environment. Increased speed in the air, increased demand on the pilots, and dependence on more and more electronically complex equipment for safe flight effect an increasing lurking anxiety, which can never be wholly dispelled in flying. The real danger in fatigue is that it is difficult to recognize and the result in extreme cases can be outright lethargy, where even the desire for survival is depressed. Since fatigue cannot be measured, it can only be presumed that the actions of some pilots who had accidents, especially in the latter stages of flight, were influenced by some degree of fatigue.

Specific Areas of Fatigue

Specific areas which may be considered in the fatigue picture are:

a. Skill fatigue in certain crewmembers induced by prolonged application at highly skilled tasks.

b. Static fatigue induced in some crewmembers predominantly as a result of boredom.

c. Static fatigue induced by prolonged confinement in restricted space and restriction by encumbering protective equipment.

d. Fatiguing effects of intense sound and/or vibration, to temperature and radiation.

e. Specialized skill fatigue resulting from prolonged use of the special senses such as visual fatigue occurring in radar scope operators.

f. Generalized fatigue as it is related to such factors as rest, sleep, morale, nutrition, and both mental and physical fitness.

A systematic analysis of these areas of fatigue and their relation to the operation of aircraft is the first step in combatting fatigue. The type of operation, stage of training, model aircraft, length of flight, time of day, weather, and the landing platform are all important considerations in determining to what extent fatigue factors can or should be eliminated or reduced. Long range planning is necessary to avoid periods of accelerated operations and insure a more even distribution of the workload. Weapons training deployments must be scrutinized critically for fatigue inducements and the potential reduced whenever possible.

External Pressures

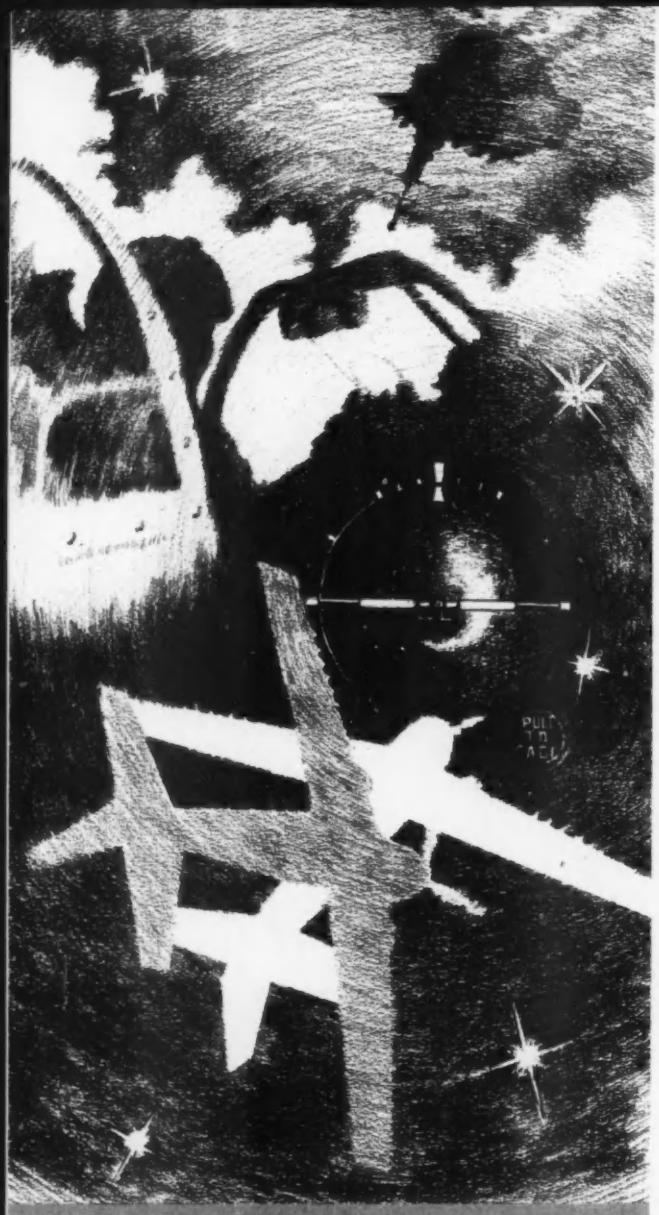
The tempo of operations is dictated by higher authority than the pilot. At various times in his tour in the Fleet he is subjected to the pressure of accelerated flying for a number of reasons. Short training cycles, the desire for a squadron to outperform other squadrons, relatively poor availability requiring long hours of operations, shortage of ready decks for day and night operations, *and the desire for some individuals in authority to make their mark*, all add up to periods where pilots can be overextended physically and mentally. These periods are beyond the control of the individual pilot, but his ability to meet the rigors of these periods is entirely within his power by closer attention to physical and mental fitness. On the other hand, those in authority should recognize the fatigue potential in accelerated or extended flight operations and attempt to reduce this potential by better planning and anticipation.

Causes of Fatigue

The causes of fatigue are classified into two groups—physical causes and mental causes. The physical agents are cold, physical discomfort, vibration, glare, wind blast, noise, accelerations, change of atmospheric pressure, hypoxia, and speed. The mental and emotional causes are boredom, responsibility, attention, concentration, alertness, apprehension, anxiety, and fear. By relating the causes of fatigue to the various positions on the flight profile of each flight, much can be done to reduce the possibility of fatigue. By this means, flying can be made safer and the result should be a substantial reduction in pilot factor accidents.

Action

All commanders in Naval Air Force, U.S. Pacific Fleet who are responsible for the operational control of naval aircraft are directed to consider the effects and potential of pilot fatigue in accelerated or extended flight operations, when originating flight schedules. Special consideration to pilot fatigue shall be given, when scheduling aircraft involved in weapons training and carrier qualifications. The utilization of assigned flight surgeons for the purpose of monitoring and advising is considered a requirement in any action taken to eliminate fatigue factors.—*ComNavAirPac Inst. 3750.2, 14 Dec '59*



'Just call me Lucky!'

It's all over, I hope. I sit back, almost relaxed, and think of all the guys who slapped me on the back, shook my hand and were really sincere in their joy of seeing me again. I think of my wife, who doesn't know what happened; of my unborn child, who someday might know. I think of life and death; of good and evil; love and hate. I wonder at the marvels of life about me. I am like a reborn man.

I shake inside when I think of it. It's still a little hard to believe. Did it really happen to me? I think back to Thursday night, two nights ago. One picture floods my mind. The picture of a pilot, half in and half out of his plane—hard hat gone, his parachute filling the cockpit — struggling desperately against the force of 220 knots of wind. I try to push the thought out of my mind. I've a story to tell—a complete story. I'm lucky. I'm glad I'm lucky enough to tell it.

THE night was hazy and the sky was speckled with cumulus clouds. We were briefed for low visibility intercepts. The flight of four ADs split up into two groups, bogey and friendly, with 1000 feet separation. Since there was no horizon and no moon, we were on instruments practically all of the time. The lead was changed among the sections and both bogey and friendly changed after two intercepts. While passing the lead, I flew into a cloud and lost sight of the new leader. I took a 30-degree cut to the left and called. Coming out of the cloud, I couldn't find the other plane so I asked him to put his lights on bright and flashing. I located him to my right and finally joined up. We were then vectored to a new heading, acting as bogey, and the leader started into a shallow right turn, in order to pass around a cloud.

I felt a little funny, looked around, up and down and saw nothing but stars. I glanced at my instruments which looked normal and went back to flying wing. Then the uncontrollable feeling that we were inverted and split-S'ing hit me. The leader's relative position on my canopy kept moving up. I found myself looking straight up at him. I couldn't figure out which way to move the stick to bring him back into position. "He's got vertigo," I said to myself as I broke away to the right. "We're flying into the water." I glanced at my gyro horizon. It looked like something that I had seen only in IFTD and that was in an unusual attitude.

"3-1 . . . 3-2. I've got vertigo," I called.

"Go on your gages, go on your gages," I heard.

"I'm spinning!"

"Bail out, bail out!"

I opened the canopy, unbuckled myself and glanced at the altimeter. Thirty-five hundred feet. I looked for the D-ring, found it and put my hand on it. (About three weeks ago I had given myself a test while flying. "What would happen if you had to bail out right now?" I asked myself. I grabbed for the D-ring and couldn't find it. It was under my left arm—almost in back. This flashed through my mind and I decided to go out with my hand on the ring.) I turned in my seat and started to lean out when another thought struck me: Would the pararaft hold me back? "No," I thought. "It's attached to the parachute." I got my head out, and the wind force whipped my hardhat away. I kept pushing, got about half my body out when the wind caught my arm and pulled it away from me. I glanced back and saw white covering the left side of the cockpit. I thought of gathering it up in my arms and jumping, but quickly discarded the thought as hopeless. I glanced at the airspeed which was reading somewhere over 200 knots. I sat back down, chopped all the power and pulled back on the stick. I watched the altimeter unwind, saw it go thru 500 feet and watched it approach zero. I remember yelling and bracing for the shock of hitting.

When I didn't hit I glanced at the gyro horizon which was relatively straight and level. I was still pulling back on the stick when I noticed the airspeed falling rapidly thru 100 knots. "Power," I thought, as I felt the plane shudder, and jammed on full bore. (Prop went up too.) I started to torque roll to the left, came back on my power and then pushed it up a little more slowly. (I must have either grayed or blacked out during a portion of this as I pulled 10-G on recovery.) The pilot chute was dangling out of the canopy so I pulled it in and tucked it under me. I then realized that the canopy was still open so I reached up and closed it.

An AD pulled up along side me, and I joined on him. "I've got to talk with him," I thought, and then remembered my oxygen mask. I plugged in the cord and called, "3-1 if you read me rock your wings." He rocked and I proceeded to tell him that I was in fair shape, that I lost my hardhat and that the parachute was filling the cockpit. Later I found out that all he heard was that I had popped the chute. Neither the ship nor 3-1 could figure out why I wouldn't answer them. We flew along for a couple of minutes and I noticed we were flying in the general direction of the ship. I looked for the straps but couldn't find them. I told myself that I would have to remember to brace myself after I took the cut to avoid getting the gunsight imprinted on my forehead. I continued to feel around for the straps and finally found and hooked up the seatbelt. This was still no good for a carrier landing I decided and finally noticed the shoulder strap caught between the canopy and the windshield. I opened the canopy, pulled the strap in and then found the other one hidden by the chute. The mere fact of getting strapped in was sufficient to give me my only feeling of joy up to that moment.

Three-one, in the meantime, had called the ship requesting they make an immediate ready deck and turn on all their lights. When we got over the ships (carrier plus escort DD) they looked like Christmas trees. We started a letdown to the left and vertigo struck me again. I felt as if I were inverted. This time I knew right away it was me and I immediately went on the gages and leveled my wings. I called stating that I didn't know whether I was upside down or not. I fought that almost uncontrollable feeling that I was inverted by my saying out loud over and over again—"You're all right. You're all right. You're straight and level at 3500 feet." I glanced at my kneeboard and noticed that near land lay to the north. I went into a shallow turn and rolled out on a heading of 360 degrees. Every time I glanced out of the cockpit all I could see were stars. I called saying I was heading towards land, giving my heading and altitude. I glanced at my kneeboard once more, got the frequency of the diversion field homer and attempted to tune it in by watching the needle swing. (Later I found out the homer wasn't working.) I couldn't get the needle to swing so I gave it up and concentrated on flying instruments. I was in and out of clouds for what seemed like 15 minutes when I noticed a blinking white light to my left and low. I thought it was a ship until it cut in front of me and swung back to a heading of north. I realized that it must be 3-1 and that he was going to lead me to shore. I decided not to join on him but just keep him in sight and continued to fly instruments.

When we finally hit land, the lights of the city gave me a good reference and I joined up on 3-1's wing. We landed without further incident. It was then I noticed the cracked canopy, the 10-G and my sprained arm.

HOT POOP

After a pilot landed his jet short of the runway a senior officer in the chain of command wrote this endorsement which is of interest to pilots in hot weather flying:

This accident illustrates two principles that have too often been disregarded in the past and that require continued emphasis:

(1) When the throttle is retarded in a turbojet, the engine then acts momentarily as a brake—air which passes through the engine will be exhausted at a speed lower than the entering speed. The reason for the lower exit velocity is that the compressor and turbine efficiencies are lowered. The sudden reduction or cut-off of fuel results in less energy being developed to aid in exhausting compressor air at a high rate.

(2) High atmospheric temperature caused the pilot to be at, or near minimum power.

Although his approach speed was normal and his RPM approximately normal for a normal temperature day, he was developing less than normal power and, as such, was at a critical point on the power curve in the region of reverse command. The retarding of the throttle reduced his airspeed which put him almost immediately on the backside of the power curve.

Flight Levels

RECENT CAR requires the use of an altimeter setting of 29.92 inches whenever operating above 23,500 feet ASL. Such altitudes are called "Flight Levels" and are given in hundreds of feet, i.e., 24,000 is flight level 240. Theoretically, there can never be a conflict between an aircraft at 23,000 feet and a currently reported sea level altimeter setting and one at 24,000 feet with a standard setting of 29.92, because the ATC controller is required to maintain knowledge of the pressure variables and not use a 29.92 flight level that will conflict with another airplane below, which is on reported sea level pressure.

The CAR goes further to charge the pilot flying above 23,000 with the responsibility of making sure he is not flying below 24,000 MSL. Mistakes do occur, however, and it's well to remember that pressures below 29.92 might place your actual position too close to the lower flights. Reported pressures above 29.92 increase the separation between these levels, so they're no problem.

Lowest Usable Flight Levels

The following table gives you the lowest usable flight levels at various reported sea level pressures. For example, if you were assigned 240 and the pressure reported by a nearby ground station was 29.85, there would exist a possible conflict between your level and the 23,000 feet altitude used by the aircraft below you. The next level above 240 used by westbound flights (or 260) would have to be requested to assure proper separation.

Reported Pressure	Lowest Usable Flight Level	Flight Level Actually Used: Eastbound (0°-179°)	Flight Level Actually Used: Westbound (180°-359°)
29.92 & over	240	250	240
29.91 to 29.42	245	250	260
29.41 to 28.92	250	250	250
28.91 to 28.42	255	270	260
28.41 to 27.92	260	270	260

FSF APB 59-11

TEMPO

THESE are the days of pressures, pressures to do this, pressures to do that, pressures exerted on everyone for all things from all sides. Whether you're a buyer or seller, a driver or a rider, a "queen bee" or a "drone," the pressure to get the job done is on. A few years ago Flight Safety Foundation featured an item on tempo in one of its Accident Prevention Bulletins (APB-55-25). It had been written by a large airline for its pilot personnel. It is felt that pressures are being exerted in some phases of aircraft operations which, unless checked, could lead to mishaps, perhaps even fatalities. Because this original item on tempo said it well, we are here repeating it, as the proverbial food for thought:

"The dependability of an airline operation is largely the function of careful planning, timing, and coordination which results in operations as planned.

"The problem we are considering here is the one associated with the beginning of a breakdown of planning or where factors begin to interfere with the operation to the extent that 'the pressure is on.' Pressure in itself is of no particular importance until . . . it begins to force an operation into a tempo which causes people to hurry. One of the most frequent contributing forces to job hindrance and accidents has been that of hurrying. And hurrying in itself is not dangerous when the pace is such that people can keep up with it and still adhere to the normal good practices to which they are accustomed. However, when the tempo begins to increase to the point where people are extending themselves, then we find ourselves confronted with a situation in which hurrying becomes a dangerous factor.

"The wise supervisor, in watching his operation, will begin to sense an increase in tempo when people begin to make mistakes or begin to push themselves and others with the usual remark, 'Hurry up, Joe, whatcha waiting for?' It is at this point that we must recognize that change of pace or a reduction of tempo is in order. Without it, an accident or some other form of hindrance is inevitable.

"When tempo increases, response begins to fall behind the requirement of the pace, and soon people begin working, operating and thinking faster than they can normally handle any given situation. It is an even more important factor when it involves groups of people attempting to coordinate their efforts. It applies to operations in the cockpit when a flight becomes involved.

"The wise pilot will slow down the operation or hold up until all factors are satisfied, and then proceed accordingly."

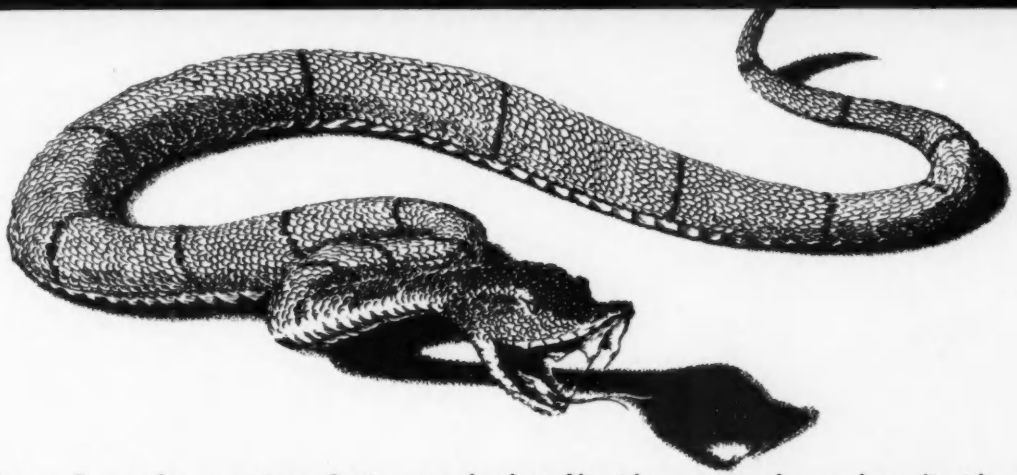
1st MAW "Wingtips"

HANDLE WITH CARE

THE Federal Stock Number for live snakes we don't have. A healthy respect for liquid oxygen we do. Unfortunately, everyone in naval aviation does not seem to share our "Handle With Care" attitude—a regrettable situation which can lead to severe cold injury, fire, explosion and liquid oxygen contamination.

The other day, an inspector-pilot type dropped by and unofficially unloaded a few of his observations on how liquid oxygen is being handled at various installations around the country. Some of the

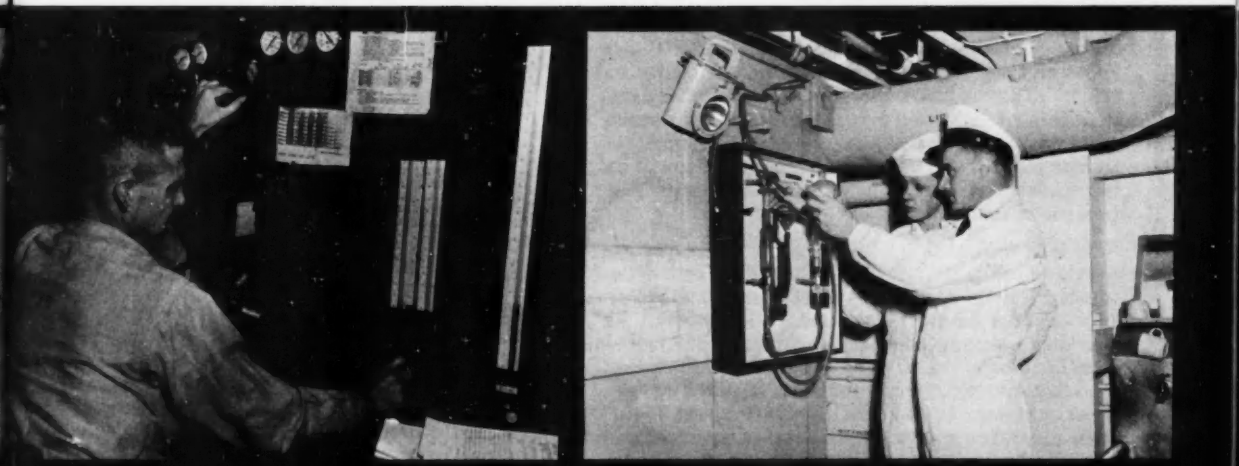
Wearing face shield and gloves, a LqOx handler services an FJ (left). The LqOx cart he uses is similar to the one the AME3 is working with above. Note overflow pan placed under the cart to keep spilled LqOx from creating a possible fire or explosion hazard on the ground.



Take one live snake, one piece of string, one bucket of liquid oxygen, and several new liquid oxygen handlers. Tie string to snake, dip snake in liquid oxygen. Remove. Drop snake on ground. Snake breaks in fragments. Result: New liquid oxygen handlers go away deeply impressed with the hazards of their profession.—*Courtesy Anonymous Naval Air Station.*

news was good but most of the situations described showed much room for improvement. (Perhaps our optimism is unwarranted, but we hope the situation is better aboard ship.)

For instance: With only a few exceptions, LqOx handlers didn't use caps on transfer hoses. Checking the hoses early in the morning, the inspector-pilot found them filled with dirt and condensation. The handlers' attitude, which was typical, was, "It will all come out in purging." . . . At another base, four liquid oxygen carts were out of commission because the handlers had dragged the hoses along the ground until the aluminum shielding had worn off. . . . At another air station where six aircraft were being serviced with liquid oxygen, none of the workers had on face shields or goggles. No one had on a pair of gloves although *one* man had on *one* glove. Questioning the men, he learned that they had proper equipment but it was back in their lockers. . . . At still another station, the LqOx carts were "filthy." . . . At many stations, there was dirt and grease in



To check for proper altitude operation, a PRI puts the Mini-reg.on a test stand. At right an MMC tests the purity of the carrier's LqOx.

Proper repair and maintenance of the Mini-reg and LqOx system components, plus sound preflight and hookups, will help assure successful missions.

the area in which LqOx was being used. Many handlers failed to use a pan for overflow. . . . A lack of adequate supervision exists in many areas. At one station, 150 aircraft were on the line but only one maintenance chief (and no officers) was seen in a two-hour period. . . .

Many pilots seemed unconcerned about the conditions surrounding the handling of liquid oxygen although they were the ones who were going to use it. They evinced similar unconcern about the condition of their oxygen masks. Oxygen masks were very dirty and needed cleaning. At one station the "explanation" for the poor condition of the masks was that they were 500 flights behind because of the weather. . . .

Things weren't 100 percent bad in the inspector-pilot's opinion. . . . He described with relish the incident in which he was almost "sand-blasted" by two enlisted men who wanted to know what he was doing around their LqOx cart. . . . He voiced admiration for the chief at a southern air station who has his own system for insuring that oxygen masks are kept in top condition: after each flight, each pilot's oxygen mask is checked, cleaned and inspected, then sealed in a plastic bag tagged with the owner's name. The pilots drop their masks off in a bin when they come in from a flight and pick up their masks before their next trip. . . .

Admittedly, the LqOx handler can't correct all his difficulties by himself. . . . Perhaps he needs a cap for the transfer hose which will go on the nozzle more easily. . . . Maybe he would wear his protective clothing if it were kept in a locker on the LqOx cart itself. . . . In the A4D the problem of engine oil and hydraulic fluid leaking down onto the LqOx converter and running on the deck when the door is dropped is beyond the LqOx handler's control.* (Appropriate recommendations to BuWeps will highlight these problems.) However, the entire LqOx handling and oxygen mask situation can be improved *by proper supervision on the line* and *by vigorous action by squadron commanders and CO's of bases.*

LqOx in Aircraft

Everyone in naval aviation should be generally familiar with the conversion of liquid oxygen into gaseous breathing oxygen as shown schematically on page 23.

In aircraft, liquid oxygen is carried in its liquid state in a converter equipped with the necessary valves and tubing for vaporizing the liquid and warming the gas to cockpit temperature for breath-

*This problem has beeen remedied in the A4D-2N by placing the LqOx converter aft of frame 357. The converter is reached through an access door on the lower right-hand side of the fuselage. The converter is in a sealed compartment away from the engine oil and hydraulic fluid.

ing. The converters are, in general, spherical "thermos" bottles with double-walled vacuum insulation. A coil tube around the converter receives the liquid oxygen, vaporizes it and delivers the gas at nearly ambient air temperature to the oxygen distribution lines. Converters are attached to the airframe with metal brackets and straps. In the new quick-removable converters, the flask carrying the liquid oxygen can be easily and quickly disconnected from the vaporizing tubing which is built in as an integral part of the airframe equipment.

Some of the valves used in the liquid oxygen system are manually operated. Others are automatic. The valving which controls the system pressure, for example, is automatically actuated to maintain a system pressure of approximately 70 psi. On the other hand, the filler valves are operated manually to allow an initial filling at atmospheric pressure. This is followed by a system pressure buildup which achieves the required 75 psi. An automatic pressure-relief valve on the converter positively prevents excessive pressure buildup and thus precludes the danger of an explosion.

Tubing for liquid oxygen systems is aluminum rather than copper as is used for gaseous oxygen. Because the liquid oxygen system operates under relatively low pressure, the tubing does not have to be as strong as that used in gaseous oxygen systems. In the liquid oxygen system, the tubing and its component valves make and maintain system pressure by converting the liquid oxygen into gaseous oxygen. When liquid oxygen is converted to gaseous oxygen in the system, it expands in the ratio of approximately 860 to 1. After the system is filled and goes into build-up (manually or automatically), the pressure rises to 75 psi. The pressure-closing valve closes and the system is ready for use. Any further pressure rise will open the pressure-opening valve and allow gaseous oxygen to be breathed from the economy circuit. Excessive pressure is relieved overboard through a pressure relief valve.

Oxygen Breathing Regulators

Four different oxygen breathing regulators are currently being used in naval aircraft with liquid oxygen systems.

The only console regulator in current Navy use is the Bendix 2867-7B-C1. This regulator, familiar to most flying personnel, is almost identical to other pressure breathing-back regulators. The only noticeable external difference is the pressure gage, calibrated from 0-150 psig instead of from 0-2000 psig as on other console regulators. Internal differences are minor.

The three personnel-mounted regulators used

Aboard ship, LqOx is transferred from the generator to the storage tank under the supervision of an MMC. Below, the same two men operate an air separator, main unit of the LqOx generating plant.

with the liquid oxygen systems differ radically from the console regulator. These are the Firewel, Robertshaw-Fulton, and Bendix. At this writing, the Firewel F-1732 "mini-reg" is the most widely used of the three. (*See page 22.*)

Last year, only three cases of pilot difficulty with the breathing capability of the mini-reg were reported to the Naval Aviation Safety Center.

Contamination a Problem

Liquid oxygen has a great attraction for gases, as any pilot who has come in from a flight and complained of odors (which remind him of everything from eau de JP-5 to yesterday's onions in Joe's Diner) can testify. Instances of oxygen contamination are extremely difficult to track down and prove.* However, suspected sources of contamination reported at various times over a period of years have been stack gas blowing across the oxygen plant ventilators aboard ship, smog and fumes in the vicinity of commercial manufacturing plants ashore, and even lubricants used on oxygen transfer trailers.

Contaminated oxygen with a noxious or nauseating odor can incapacitate a pilot with serious consequences, especially in today's high performance aircraft. All personnel working with liquid oxygen ground support equipment and aircraft systems should take every possible precaution to maintain the quality of the liquid oxygen supply and to prevent contaminants from being introduced into the supply during generation, storage and transfer operations.

Prevention of Contamination

Ground handling personnel have the major responsibility for preventing contamination of liquid oxygen. Here are a number of precautions which can help in this difficult task:

- Never store liquid oxygen in or around areas in which odors of any type may be absorbed by the liquid oxygen. Remember that liquid oxygen has a high affinity for many gaseous compounds.
- Be extremely careful to insure that dirty or oily equipment is never used with liquid oxygen equipment.
- Be absolutely sure that liquid oxygen transfer hoses are always capped except during transfer operations.
- When filling aircraft systems, always purge the transfer hose until liquid flows before connecting it to the aircraft filler valve.
- Never allow liquid oxygen storage tanks, servicing trailers, or aircraft systems to go dry

*Once a contaminant separates out, the liquid is no longer homogeneous, and a sample taken from the mixture will probably not contain a representative amount of the particular contaminant. —AMC Surgeon's Information Bulletin, Vol. V, No. 5, 1 Sept 1959

and be exposed to the atmosphere. When liquid oxygen equipment is emptied for any reason, it should be closed to the atmosphere in order to prevent the introduction of water vapor or odors.

● Purge liquid oxygen equipment in accordance with the practices outlined in NavAer 06-30-501 (Handbook for Field Handling of Liquid Breathing Oxygen) and BACSEB 39-59. These publications also give the required procedures for testing for and reporting contamination.

The approved cleaning compound for oxygen systems can be requisitioned in gallon units (usually comes in five-gallon containers), FSN R6850-597-7166-G500, Mil. Spec. MIL-C-8638/AER/AMI.

Liquid Oxygen Handling Hazards

The potential hazards in handling liquid oxygen are the result of its chemical activity and two of its properties: extreme cold and expansion upon conversion to gas.

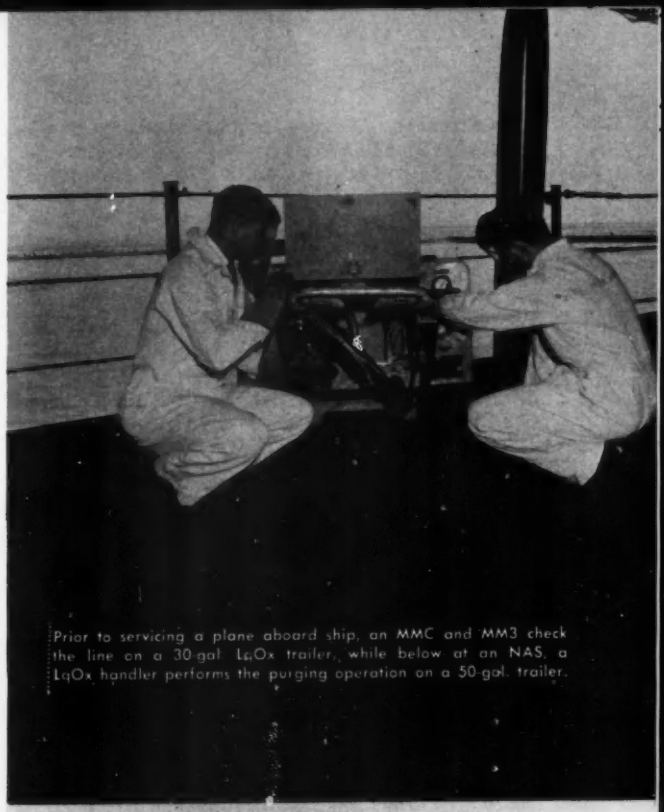
Because of its extremely low temperature, liquid oxygen can freeze or seriously damage human tissue on contact. The effects are similar to those caused by frostbite or burn. If you work with liquid oxygen, take care to stand clear of boiling and splashing liquid. Be particularly careful when filling a warm container as vigorous boiling, splashing and gasification may take place.*

Freezing Hazards: Under certain conditions, valves and connections on liquid oxygen plumbing will freeze and water vapor from the atmosphere will condense and freeze on uninsulated parts. If you touch these areas without protection they may freeze to your skin on contact. You can tear your flesh or suffer severe cold injury while attempting to free yourself.

Fire and Explosion Hazards: Because oxygen supports combustion, all combustible substances will burn with much greater intensity in an oxygen-enriched atmosphere such as may be created if liquid oxygen is accidentally spilled in a poorly ventilated area. Some substances that won't burn in air will burn vigorously in any oxygen atmosphere. As a precaution against this, always handle liquid oxygen in well-ventilated areas.

If exposed to liquid oxygen under certain conditions of temperature and pressure, some organic materials and flammable substances react violently with it. (These include oil, grease, dirt containing oil or grease, tar, asphalt, gasoline, kerosene, JP fuel, propane, butane, alcohol, ether, hydrogen, illuminating gas, acetylene, paint, cloth and wood.) If exposed to liquid oxygen, these materials will burn violently even when ignited several minutes

*Liquid oxygen boils at —183°C or —297°F. The critical temperature of oxygen is —118°C or —180°F and the critical pressure is 735 psi. Any further increase in pressure will not prevent LqOx from evaporating at this temperature.



Prior to servicing a plane aboard ship, an MMC and MM3 check the line on a 30-gal. LqOx trailer, while below at an NAS, a LqOx handler performs the purging operation on a 50-gal. trailer.

after exposure. If vapor from liquid oxygen mixes with fuel vapor in certain proportions, the mixture will explode in the presence of a sufficient source of ignition.

All combustibles are potential explosion hazards when mixed with liquid oxygen. Mere mixture of liquid oxygen with powdered organic materials under certain conditions may cause explosion.

When liquid oxygen is vaporized and warmed to ambient temperature, one volume of liquid oxygen will expand to 862 volumes of gaseous oxygen. If this evaporation and expansion takes place in a confined space, explosive pressures will be created.

Precautions Before Recharging Aircraft System

Make sure before recharging an aircraft liquid oxygen system that:

—The aircraft is in an open ventilated area.
—The aircraft is not being fueled.
—The aircraft is static grounded.
—The aircraft electrical system is OFF.
—No APU's or starting units are connected to the aircraft or are operating in the vicinity.
—A CO_2 fire extinguisher is immediately available.
—Personnel are kept clear of the overboard vent.
—The deck under and in the immediate vicinity of the overboard vent is free from grease, oil or any other combustible material.

"It has been noted that liquid oxygen personnel are not using safety equipment while servicing aircraft. Must we await the death or serious injury of one of our men before insuring the use of safety equipment?"
—Staff NCO Maintenance, Material and Flight Safety Committee Report

Precautions Aboard Ship

Special precautions are necessary aboard ship:

● When smoking or carrying an open or unshielded light or any potential spark-producing apparatus, do not enter an oxygen storage compartment that has not been purged. Do not approach any point where oxygen is being discharged or where a piping leak is suspected.

● Exercise care in handling ammunition near oxygen.

● Keep open flames at least 100 feet away from oxygen storage tanks of oxygen equipment.

● Oxygen storage and handling compartments should be sprayed with one coat of fire-resistant paint before being used. However, first remove any other existing paint from plant and equipment and thoroughly clean them to bare metal.

● Do not permit painting when liquid oxygen is contained in the compartment.

● During transfer operations, position the transfer trailer so that it will not shift with the pitch and roll of the ship. Lock the brakes and tie down the trailer.

Fire Prevention Aboard Ship

In any area where oxygen is being handled or stored, do not permit smoking, open flames or any other means of ignition such as grinding operations, metal on shoe soles, lighters, matches or any operating heater.

Signs reading LIQUID OXYGEN should be posted in a conspicuous place on all storage tanks, compartments and handling rooms. CAUTION and NO SMOKING signs should be posted at entrances and hazardous points. When liquid oxygen piping that is not enclosed in a double wall or flametight casing is in use, NO SMOKING signs should be posted in the compartments containing the piping. When the plant is shut down, these signs should remain until piping has been purged with nitrogen.

References:

BACSEB 42-54—Diluter-Demand Oxygen Systems: General Information
BACSEB 3-56B—Oxygen Recharge Trailers, Safety Precautions for Use of (applies to liquid oxygen as well as gaseous oxygen)
BACSEB 5-56—Liquid Oxygen, Safety Precautions for Storage and Transfer
BACSEB 8-60—A13A Oxygen Mask Exhalation Valve—Bendix; and Firewel Miniature Oxygen Regulators; chafing of
BACSEB 22-57—Liquid Oxygen Equipment, Aircraft Carrier; General Operational Instructions for
BACSEB 39-59—Liquid Oxygen, Equipment, Operational Instructions, General Info on Detection, Correction of Contamination
NAVAER 06-30-501—Handbook: Field Handling of Liquid Breathing Oxygen (1 Aug 59)
NAVAER 00-80T-52 (Rev 1959)—Safety and Survival Equipment Manual

Protective Clothing For LqOx Handling

Reference: Section G NAVAER 00-35QG-17 dated April 1959

Face Shield: Industrial—Page 122, Item 50
Glove: Leather, Gas Welder's, Large Left Hand Page 126, Item 30
Glove: Leather, Gas Welder's, Large Right Hand Page 126, Item 35
Shoes: Safety—Page 126, Items 40-65, Sizes 8-D-10EE
Apron: Battery Worker's—Page 100, Item 85

Reference GSK Catalog, Group 84, Part 1, Page 53

Coverall: Explosive Handler's (PreShrunk Cotton)
Coverall: Explosive Handler's (Sateen)
Coverall: Explosive Handler's (Herringbone Twill)

HANDLE WITH CARE

Precautions

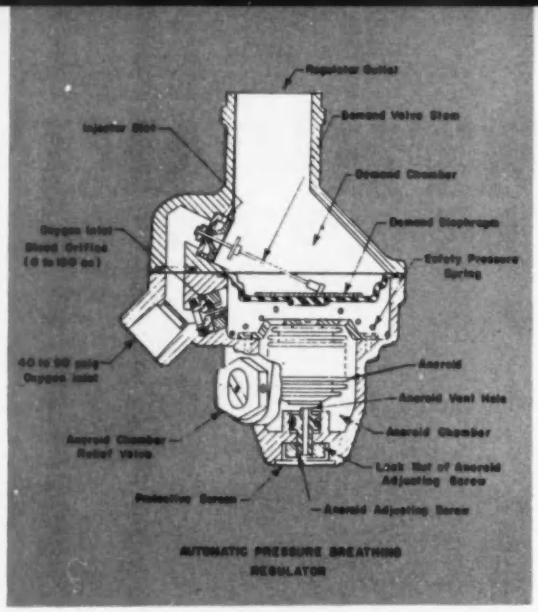
The following precautions apply to handling liquid oxygen:

- Do not operate liquid oxygen equipment unless you are qualified or are working under the supervision of qualified personnel.
- Wear goggles or safety glasses with side shields, or a face shield when handling liquid oxygen.
- Do not handle with your bare hands any tubing or fittings through which liquid oxygen is flowing. Wear clean, dry gloves when handling parts of equipment cooled by liquid oxygen. Leather gloves are preferable but asbestos gloves may be used if they are treated or lined to prevent the penetration of splashed liquid. Gloves should be loose-fitting so they can be thrown off quickly if any of the liquid oxygen gets into them.
- In the event that liquid oxygen is spilled on clothing, remove the clothing immediately and air it promptly. In general all clothing should be worn so that in the event of spillage, the liquid will roll off the clothing and not become trapped in gloves, shoes or pockets. Other items of protective clothing advisable are an asbestos, leather, rubber or plastic apron, high top shoes and cuffless trousers worn outside the shoe tops. The clothing should not have pockets and sleeves and trousers should not be rolled up.
- In the event that the body comes into contact with liquid oxygen or there is reason to suspect some part of the body has been frozen or chilled, thaw the exposed area, preferably by immersion or by bathing it in water which is slightly above normal body temperature, wrap the exposed area loosely with clean, dry dressing and report to a doctor immediately. Do not apply anything else to the affected area other than the clean, dry dressing.
- Do not permit smoking, open flames, or sparks in the liquid oxygen handling areas.
- Do not carry matches in liquid oxygen handling areas.
- Keep work area and equipment free from oil, grease or any other combustible material.
- Keep tools and clothing free from oil and grease.
- Avoid spilling liquid oxygen on floor or deck areas. In case of accidental spillage, ventilate the area thoroughly.
- Always call oxygen by its proper name. Do not confuse it with compressed air. Never use oxygen in place of compressed air for any purpose.

A LqOx handler refills the LqOx system of an F11F. A cup is used to catch overflow.

- Handle converters, storage tanks, and transfer hoses with care to avoid damage to the insulating space.
- When transferring liquid oxygen, do not leave valves open all the way. Open valves wide, and then immediately close them about one-quarter turn; otherwise they may freeze in the open position.
- Disconnect filling or transfer lines as soon as the transfer process is completed.
- Do not leave liquid oxygen in a closed container or trapped in a line between two valves; always open a valve on one end to avoid excessive pressure buildup.
- Use only standard approved equipment in the handling and storage of liquid oxygen.
- Do not introduce moisture into the system. Exercise care to insure that no moisture is present on filler valve nozzles when they are connected or disconnected.
- Purge piping and equipment with dry, oil-free air or nitrogen before and after making any repairs.

For detailed information on the widely used Firewel Mini-reg, please turn the page . . .



HANDLE WITH CARE

How the Firewel Mini-Reg Works

The Firewel F-1732 mini-reg is used both in flight and in bailout or emergency conditions. The regulator assembly weighs four ounces and measures approximately 2.5 x 3 inches. The regulator is designed so that at an inlet pressure of 40 to 90 psig, it delivers 100% oxygen automatically to the user between the altitudes of 0 and 50,000 feet. In addition, the regulator incorporates automatic safety pressure build-up to a maximum of 2 inches of water below 35,000 feet and automatic pressure breathing for altitudes about 35,000 feet. It is designed to integrate with the A13-A oxygen breathing mask.

The F-1732 mini-reg consists of a demand valve assembly, demand diaphragm safety pressure spring, pressure breathing aneroid, oxygen inlet bleed orifice, aneroid vent outlet, aneroid chamber and relief valve as shown above.

An unbalance of the pressures on either side of the demand diaphragm will cause movement of the diaphragm in the direction of the lower pressure. The force of the safety pressure spring (maximum of 2 inches of water pressure) causes motion of the demand diaphragm in the direction of the demand chamber. Motion in this direction causes actuation of the demand valve, thereby admitting oxygen from the 40 to 90 psig source to the regulator outlet and consequently to the A13-A oxygen mask. When the force on the demand chamber side of the diaphragm (due to the mask pressure) is equal to the force on the aneroid chamber side of the diaphragm (due to the safety pressure spring), the diaphragm becomes balanced and the demand valve closes. By this action a safety pressure of a maximum of 2 inches of water is maintained in the oxygen mask. The decrease in pressure in the demand chamber (due to inhalation) causes a motion of the demand diaphragm in the direction of the demand chamber, thereby actuating the demand valve and consequently allowing the oxygen required for inhalation to pass into the A13-A oxygen mask. The increase in pressure in the demand chamber (due to exhalation) causes a motion of the demand diaphragm in the direction of the aneroid chamber, thereby allowing the demand valve to close so that exhalation can be accomplished through the A13-A oxygen mask exhalation valve.

The aneroid or pressure breathing control chamber consists of an aneroid pre-set to begin expanding at approximately 35,000 feet, an oxygen inlet bleed orifice, aneroid vent outlet and a relief valve.

Oxygen is continually transmitted from the 40 to 90 psig oxygen source through the oxygen inlet bleed orifice to the aneroid chamber and finally is exhausted to the ambient atmosphere through the aneroid vent outlet. Since the oxygen flow through the bleed orifice is minimal (maximum approximately 150 cc per minute) and since this oxygen is continually exhausted to the ambient atmosphere, the aneroid chamber remains at essentially ambient pressure. However, as pressure breathing altitudes are approached, the aneroid expands and gradually closes the aneroid vent outlet. This increases the pressure maintained in the aneroid chamber and consequently back loads the aneroid side of the demand diaphragm with this same pressure. The unbalance of the diaphragm causes motion of the diaphragm in the direction of the demand chamber, thereby actuating the demand valve and allowing oxygen to flow into the oxygen mask. When the force on the demand chamber side of the diaphragm (due to the mask pressure) is equal to the force on the aneroid side of the diaphragm (due to the aneroid chamber pressure) the diaphragm becomes balanced, and the demand valve closes. By this action, the pressures are maintained in the oxygen mask at various altitudes.

When at altitudes above 43,000 feet the expansion of the aneroid is so great that the aneroid chamber pressure increases above the maximum allowable pressure, a relief valve installed in the

aneroid chamber is pre-set to open and thereby maintain the aneroid chamber at a prescribed maximum pressure.

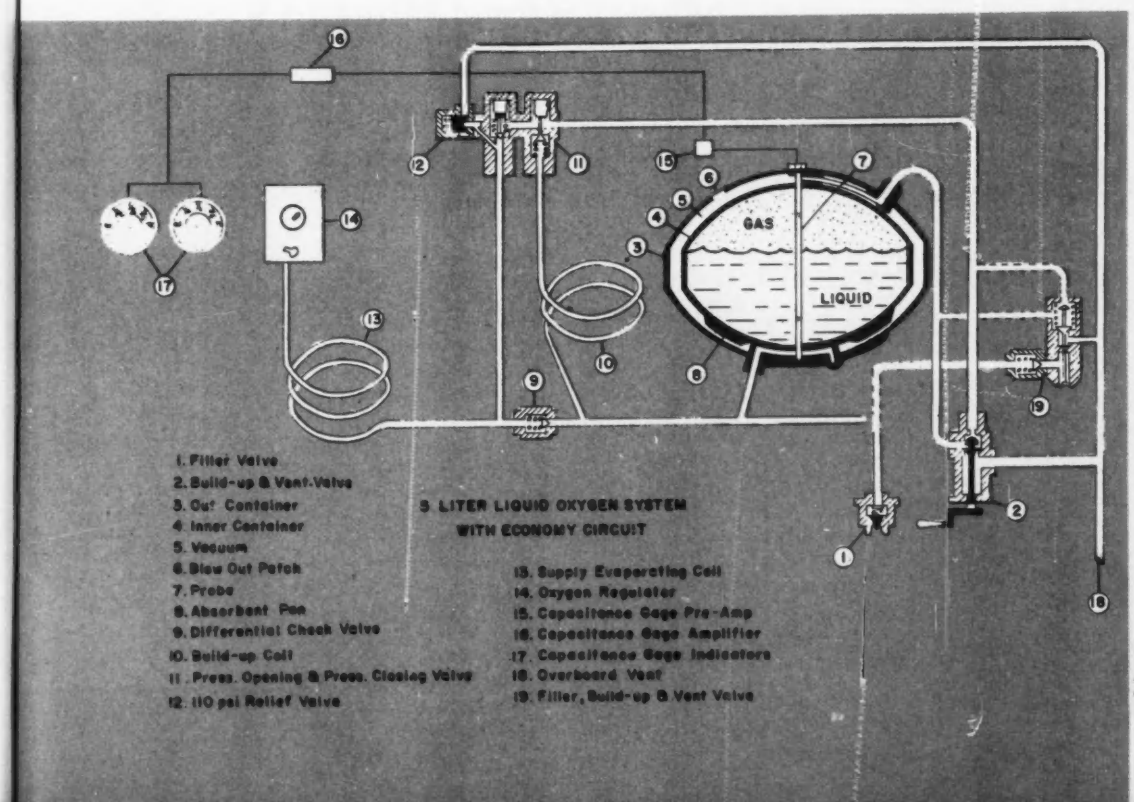
5-Liter System With Economy Circuit

1. *Filling*—With build-up and vent valve in the "vent" position, liquid oxygen flows into the system through the filler valve, into the container. The container is considered full when a steady stream of liquid flows from the overboard vent.

2. *Build-Up*—With the build-up and vent valve in the "build-up" position, liquid oxygen flows into the build-up coil. During passage, liquid oxygen absorbs heat and changes into gaseous oxygen. When the pressure reaches 75 psi, the pressure-closing valve closes and the system is ready for use.

3. *Stand-By*—If the system is not used immediately, pressure will gradually build up to 82 psi from heat gain. At 82 psi the pressure-opening valve will open. This allows gaseous oxygen to be used from the top of the container when the system is first used. Any pressure increase above 110 psi will be relieved through the relief valve and overboard vent.

4. *Use*—When the system is put into use, gaseous oxygen flows from the top of the container, through the pressure opening valve, through the supply heat exchanger coils (raising the temperature of the oxygen to normal breathing temperature). As the oxygen pressure decreases to 82 psi, the pressure opening valve will close and the supply line (bottom of oxygen container) will furnish the system with oxygen. During normal system use, the pressure may decrease below 75 psi, allowing the pressure-closing valve to open and increasing the pressure in the top of the container. A check valve, installed between the output lines of the pressure-opening valve and the pressure-closing valve, prevents backflow of oxygen pressure to the supply line when the pressure-opening valve is open. The liquid oxygen is converted to gaseous oxygen immediately upon leaving the container because of the rise in temperature of the supply line. ●



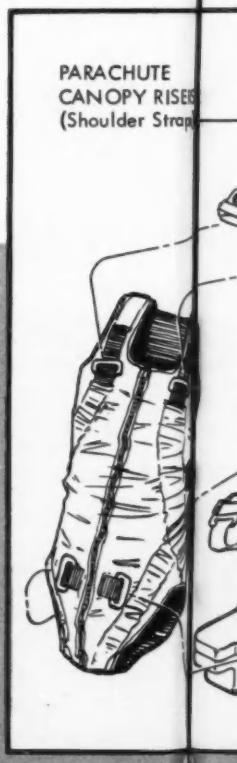
5 LITER LIQUID OXYGEN SYSTEM WITH ECONOMY CIRCUIT

THERE IS NO SUBSTITUTE FOR A

D-RING C

DURING parachute descent over water (and also over land) yank the rip cord D-ring handle out of the pocket on the left-hand riser. Assuming that your parachute was deployed by the automatic opener, this one yank will free the ripcord housing clip from its retainer pocket on your left shoulder leaving only the two canopy release fittings at your shoulders to be turned loose when you hit the water. If you don't do this, the parachute canopy may settle over you or drag you after you hit the water, even though you have unbuckled the canopy release rocket jet fittings.

The ripcord D-ring handle and related ripcord are secured to the pack. The pack is secured to the torso suit by hip straps. The D-ring fits in a pocket on the canopy shoulder strap and is safetied by a strand of nylon thread. If the D-ring handle is still in the pocket of the shoulder strap when you hit the water



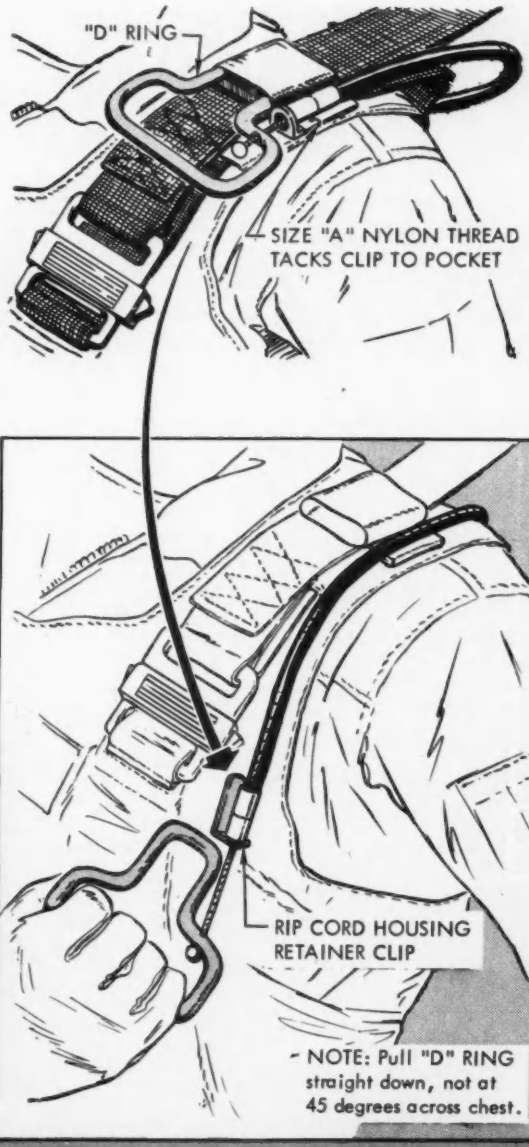
Drawings Courtesy of North American Aviation Service News (Columbus Div.)

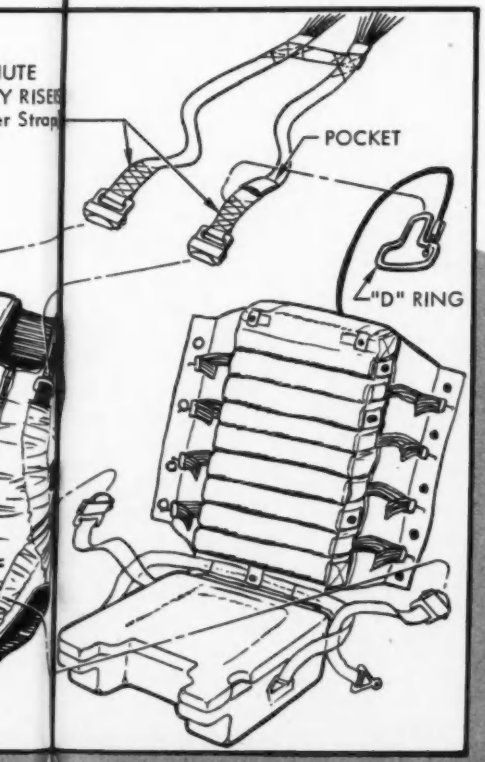
A LITTLE PULL WHEN YOU NEED IT.

ARCUS

(or ground) the canopy is still attached to you by the ripcord.

Note: Before contact with water (or ground), pull the D-ring handle hard enough to clear both the handle and the ripcord housing retainer clip from the pockets on the shoulder strap. This would then require disconnecting only the shoulder rocket jet fittings instead of both hip and shoulder fittings in order to release the parachute canopy after landing.


"D" RING
SIZE "A" NYLON THREAD TACKS CLIP TO POCKET
RIP CORD HOUSING RETAINER CLIP
NOTE: Pull "D" RING straight down, not at 45 degrees across chest.



The integrated parachute can drown you—if you don't pull the ripcord D-ring handle.

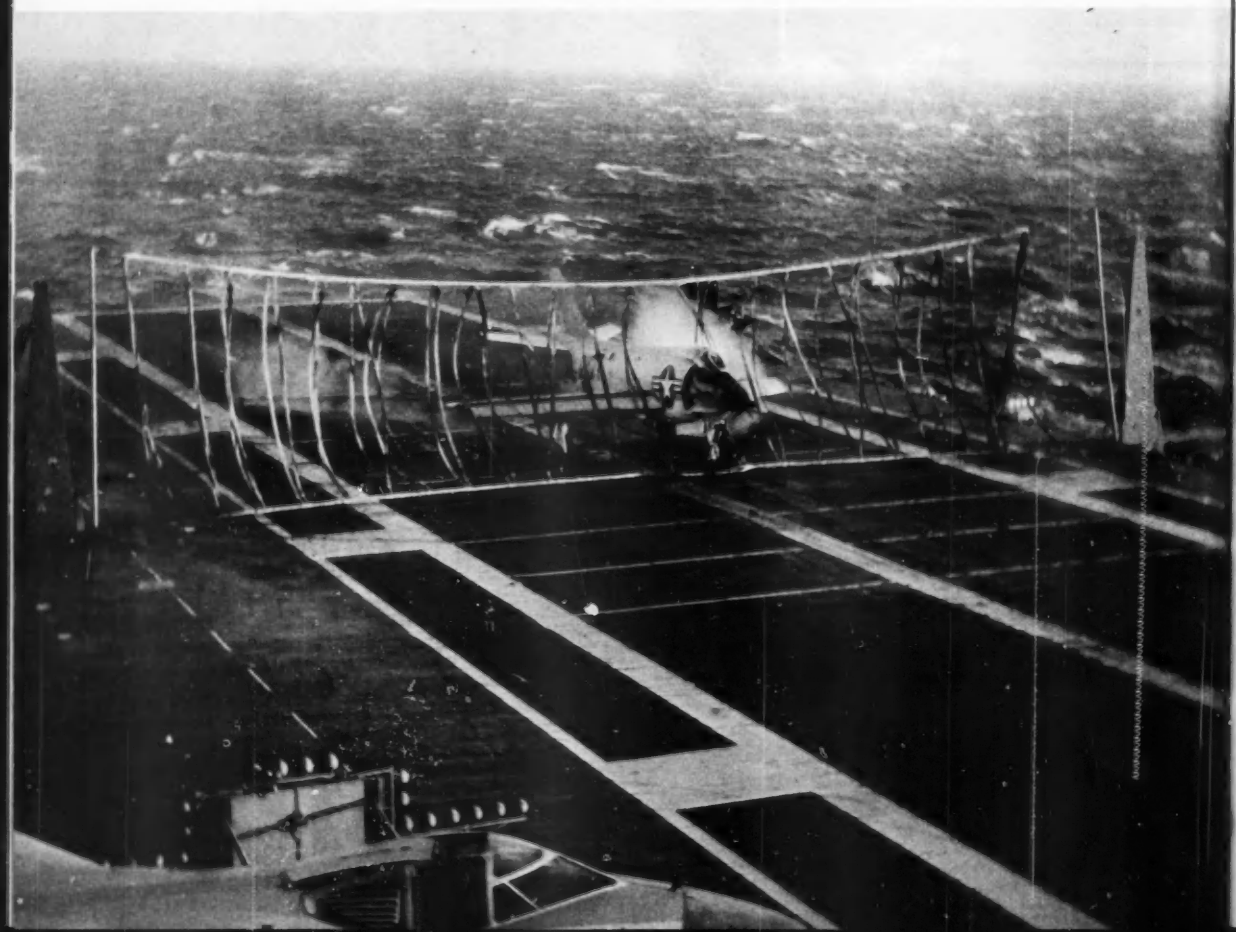
CONFIDENCE GAME

He put his money on the eyeball instead of the meatball.

"I believe that this accident was partly due to the fact that I knew the port mirror had been malfunctioning and that it could have been malfunctioning again in the same manner as previously described."

It was this kind of playing the odds that led the pilot of the F3H-2 to continue his approach to a pitching deck when the meatball went off the top of the mirror.

Conditions were far from ideal. The sea condition, 10 to 15 feet, produced a moderate to heavy pitch, a slight roll, and an occasional heave or slide.



The pilot knew the best way out. "Under normal conditions, the correct procedure for losing the meatball close-in is to execute an immediate waveoff. The port mirror on the (CVA) has had a history of malfunction in its stable element. Successful landings have been made on the port mirror when the meatball went out the top when the approaching aircraft were close-in."

But he put his money on the eyeball instead of the meatball—and lost. The result was a hard landing, two blown main tires, a failed port main scissors, a port wheel twisted 90 degrees to the line of travel and a bolter.

From here on he did everything right. On the second pass with the barricade rigged he grabbed the number one pendant and completed a very successful barricade engagement.

Fuel state was never a consideration in the episode. There was plenty aboard for several approaches. All that is left is a case of trying to second-guess a mechanical device which just happened to be working fine.

The Board wrapped it up, "The underlying reason that the pilot placed himself in this position was, by his statement, his lack of confidence in the stability of the optical landing system under pitching deck conditions.

"Coupled with this lack of confidence in the OLS must have been a subconscious confidence in his own ability to accurately establish and gage his rate of descent without assistance. He has now forcibly learned that this is impossible to do with any consistency."

Touch-and-Go Wheels-Up Landings

THE Safety Center has conducted a study of wheels-up landings during the period from 1 July 1955 to 30 November 1959 to determine the relationship between touch-and-goes and this accident type. During this 53-month period there were 214 reported pilot-induced wheels-up landings; 31, or 14.4 percent occurred while shooting touch-and-goes, while 13, or 6 percent involve pilots on FCLP. The touch-and-go accidents were about equally divided between night (16) and day (15), but all of the FCLP ones happened at night.

Since all touch-and-go landings are not reported specifically the Center is unable to determine the percentage of all landings which are touch-and-goes. On the other hand, it is true that less than 5 percent of all Navy sorties involve touch-and-go landing practice. On this basis it is considered that the incidence of wheels-up landings during this type of operation is quite high.

A review of the wheels-up touch-and-go landings revealed that in every case an established habit pattern was broken. In 14 cases the pilot entered the break, made a touch-and-go, raised the landing gear, and on the *second* pass landed *gear-up*. Eight other wheels-up landings were preceded by one or more waveoffs and several circles within the traffic pattern. In all of the night FCLP wheels-up landings the LSO by his own admission disregarded the missing approach lights.

From a strict safety viewpoint the foregoing indicates that touch-and-go wheels-up landings can be reduced by requiring pilots either to leave the pattern and make a normal entry at the break following each landing or to continue in the pattern with gear and flaps down. However, in order to obtain maximum training in the use of check-off lists and aircraft controls and to reduce engine wear and tear the Safety Center recommends that each landing be preceded by a normal entry into the pattern in the cruise configuration. To reduce the incidence of wheels-up landings during night FCLP it is recommended that the importance of utilizing the approach lights to indicate "gear down" be stressed to all landing signal officers.

So You Think You've Got Troubles—

Comment on a recent USAF multi-jet bomber accident: "The primary cause of this accident was material failure in that the number 12 tire failed . . ."

Leave Investigating To The Investigator

RECENTLY an aircraft was involved in a major accident. This is not news. However, the first people on the scene were pilots from the squadron which owned the aircraft. This is slightly newsworthy. *But here's the rub.* These fearless jocks rushed in, tampered with the wreckage, moved some of the bits and pieces, altered some of the instrument readings and even removed a flight instrument.

By now, everyone in and out of the organization should be impressed with the necessity for, value of, and delicacy required in the conduct of aircraft accident investigations. Obviously, even our own people are not so impressed.

In the interests of solid investigative capability, *impress them.*

If it takes the man with the tall boots and screaming eagles to come out of the head shed with the word, let's do it that way. But anyway, let's get the word out. And make it stick.—*DFMSR "Investigation Tips"*

SID IS COMING!

Not Sid Caesar—he's been with us a long time. No, this is SID, Standard Instrument Departures, to save wear and tear on your pencil and enable you to get the gouge in advance on how you'll be climbed out of that jet-infested high-density area. CNO desires that Standard Instrument Departures be utilized at all naval air activities, and has set 30 June as a target date for all activities to comply with the OpNav Instruction 3722.23. The activities will have to coordinate the SIDs with local FAA facilities, but for pilots the only action needed is to know how the SID will be used (see the Instruction) and to ask for them after the target date. They'll be used only when filed for or requested by the pilot. A standard format will be used, and it's the same as that which will be employed by USAF bases in their Departures. SID is coming—look for it, use it!

Radio Discipline

DID you hear about the Air Force C-119 that took off from Frankfurt, Germany one overcast day? As it was making its instrument departure the copilot was communicating with Frankfurt Control. Before each of his many calls he'd blow into the mike to make sure that it was hot. After this lad had split everyone's eardrums a half-dozen times, a clipped British accent came up on the net.

"I say there old chap you have blown in my ear about five times—would you like to kiss me now?"

Ace of the Base?

A PILOT'S proficiency is not measured solely by the finesse with which he performs an inverted corkscrew clover-leaf or like maneuver designed to impress the uninitiated, but by the manner in which he gains the utmost from his aircraft through intelligent employment of the many systems and components placed in the aircraft for a purpose. Only by diligent study of the aircraft, its characteristics and systems and then integrating them with his own aeronautical ability can he become an effective, proficient combat pilot.

—*MAG 1 "Wing Tips"*

S2F Single-Engine Rudder Assist

A RECENT fatal S2F accident probably resulted from a failure to use the single-engine rudder assist when securing an engine during slow flight. There still appears to be a reluctance by some pilots to use the rudder assist because of the number of failures that occurred prior to the installation of ASC 261. Since installation of ASC 261 there have been no reported incidents involving the failure of the single-engine rudder assist. The single-engine rudder assist should be used in accordance with the Pilots Handbook NavAer 01-85SAA-1A.—*Weekly Summary*

Price Support

THE aviation safety officer is responsible to the commanding officer to insure that every possible precaution is taken to eliminate any hazard or condition that might foster an aircraft accident, incident, flight hazard or a ground accident.

To accomplish this effectively, the safety officer must be familiar with every station activity that is concerned with the support and operation of aircraft. One of the most important of these is the maintenance department.

There is a continuing need for the aviation safety officer and maintenance officer to work together in a mutual effort to eliminate accident potentials. Flight Safety meetings should be arranged for maintenance personnel which deal primarily with maintenance problems as they affect flight safety. The maintenance caused mishaps should be discussed with all maintenance personnel in an attempt to stress the importance of their duties relative to flight safety.

The seriousness and magnitude of aircraft ground handling accidents can be appreciated better if the over-all Navy statistics are known. For example, during the fourth quarter of fiscal 1959 there were a total of 205 accidents involving all areas of aircraft ground handling. These accidents involved an estimated cost of $3,200,000 and an estimated 27,200 man hours for repair. The ground handling accidents within the NAResTraCom for the fourth quarter are included in the total figures.—*CNResTra Safety Bul.*

Cause Factors

A study of the factors contributing to accidents in this Command continues to point to errors by pilots as being the greatest cause. This does not necessarily mean that pilots are less proficient but does indicate several points worthy of consideration:

(1) Pilots must be more cognizant of engineering facts and maintenance and servicing procedures.

(2) More time must be spent in study, briefings, preflight inspections and other preflight preparation.

(3) Pilots must be allowed the necessary time to work and study "flying airplanes." Professionalism is obtained only after uninterrupted concentration.

(4) Higher echelon planners and aircraft manufacturers must consider general pilot capabilities and limitations along with continued emphasis on human engineering.

—*AirFMFLant*

Setting the G-2 Compass

SERVICE reports indicate that erroneous indications may occur for periods up to 20 minutes immediately following the setting operation unless special precautions are taken during the manual setting of the G-2 compass indicator. It has been found that if the stabilized dial is rotated somewhat past the correspondence dial indication, and released with even a slight twisting motion, the stabilized dial will in many cases continue to rotate in a direction away from the correspondence dial reading as much as 40 to 70 degrees. It will then stop and reverse direction, return and stop at the heading of the correspondence indicator. Since the normal slaving action produced by the torque motor is at a rate of 3 to 4 degrees per minute, the total elapsed time for the stabilized dial to indicate correctly the magnetic heading may be considerable.

Pilots using the G-2 compass should familiarize themselves with the correct procedure to operate the reset adjustment. The following steps are essential:

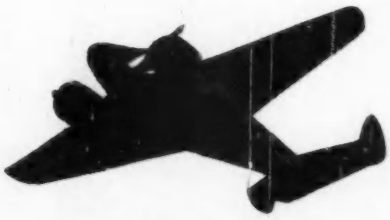
a. Depress the knob firmly and rotate the main dial to the desired heading.

b. Keep the knob fully depressed at the new heading for at least two seconds.

c. Release the knob straight out, avoiding any twisting motion.—*1st MAW "Wing Tips"*

Could this happen at your NAS?

The crash and fire crews never arrived at the scene of the crash. This was the result of insufficient information, inadequate maps, and the muddy condition of the roads. Initial information as to the general location of the crash caused the crash crew to start in the wrong direction. After the situation was corrected, a lack of detailed maps showing all the small dirt farm roads created doubt as to the best route in proceeding to the scene. When they finally arrived in the vicinity of the crash the muddy condition of the existing roads made it inadvisable for the equipment to proceed; consequently, the aircraft fire was allowed to burn itself out. This made the investigation extremely difficult. Had the fire been extinguished earlier the cause of this near-fatal COUGAR accident could probably have been definitely determined.



"I've got it!"

PILOT and check pilot took off on a first pilot check hop in an SNB. After performing various maneuvers at altitude, they decided to return to base because of a rising oil temperature in the starboard engine.

On landing, it was necessary for the pilot to use a great deal of right rudder to maintain directional control. Despite this, he was unable to prevent the aircraft from moving to the far left side of the runway. The check pilot said, "I have it!" The pilot replied, "No, I have it! I have it!" They continued down the left side of the runway and the tail wheel was lowered to the deck. About 100' further down the runway the check pilot again said, "I have it!" and again the pilot said, "No, I have it!"

About 300' further the aircraft swerved violently to the left and left the runway despite full right brake. The aircraft then slowed to about 10 knots and nosed up coming to a stop about 60' from the runway. No throttle had been used to assist in maintaining directional control.

Impact forces were negligible and there were no injuries.

The flight surgeon on the case has the following to say:

"This raises two extremely important questions. They are: 1) How far on a first pilot check should a check pilot allow his student to go before he insists on taking over control? and 2) How strongly must it be emphasized that when the instructor or senior pilot says 'I have it' that is just exactly what he means?

"The answer to the latter question is self evident," the flight surgeon continues. "However, I do not believe the first question can be answered except by the individual check pilot. (The situation varies) with the pilot's experience, his degree of cautiousness and his confidence in his student. (In this case) had positive intervention been accomplished at either point when the check pilot said 'I have it' this accident probably could have been prevented."

notes from your FLIGHT SURGEON

Crossed Up

AFTER the pilot of an A3D inadvertently retracted the landing gear instead of the flaps immediately following touchdown on the runway, he secured the engine and rode out the landing.

None of the four crewmembers were injured. One crewman, however, was unable to get out of his seat when the order was given to abandon the aircraft. *He had hooked up his parachute harness over one of his shoulder straps.* Once he got out of the parachute harness he had no difficulty in escaping from the plane. Had this accident been a ditching he might not have had time to correct his mistake.

When you strap in, *be sure* that you put both shoulder harness straps *over* your parachute harness.

Last Flight

WITH only five days of active duty remaining the pilot did not expect to do any further flying. He skipped breakfast, intending to eat at the exchange after getting to work, and reported with less than 6 hours' sleep. At the base, another pilot pleading an excess workload asked him to take his hop for him — an introductory flight for a pilot new to the HUS.

The flight was uneventful until the pilot began to demonstrate a zero airspeed autorotation beginning at 1200 feet. The pilot was apparently tardy in applying collective, encountered an excessive sink rate and was then unable to apply the necessary combination of collective and throttle to cushion the landing before hitting the deck. None of the aircraft's occupants were injured.

The reporting flight surgeon attributes the pilot's inattentiveness to three factors: lack of sleep, lack of food and preoccupation with checking out of the squadron. The pilot was totally unprepared to go flying. When presented with an opportunity, he seized it eagerly as his last chance for a flight. He was thus slightly elated and probably subconsciously had a desire to impress "the new kid on the block" who was out for the first time in the HUS, the flight surgeon states.

The flight surgeon recommends continued emphasis on the fact that aviators are responsible for keeping themselves physically fit. The fact, he says, that a pilot does not expect to go flying the following day in no way excuses him from this responsibility.

Multi-Directional Inertia Reels

AN HUS-1 pilot made a practice autorotation intending to recover at 10 feet. During the recovery, the aircraft started a turn to the left. Full right rudder was ineffective and near full power did not prevent the aircraft from settling to the ground. The aircraft contacted the runway twice, slid 15 feet, then came to rest. There was no fire. All four occupants exited the plane uninjured and without difficulty.

The flight surgeon reports that the two non-pilot crewmembers were not strapped in their seats (and that neither pilot had his inertia reel locked). Fortunately, the impact was slight.

The flight surgeon states that pilots should constantly bear in mind:

1. that the inertia reel (which locks to a forward deceleration of between 2- and 3-G) cannot be relied upon to lock automatically in a helicopter accident, and

2. that serious vertebral or other types of injury can result from a loose shoulder harness.

(BuWeps is looking into the possibility of equipping all helicopters with multi-directional inertia reels which will be actuated by G-forces from any direction.—Ed.)

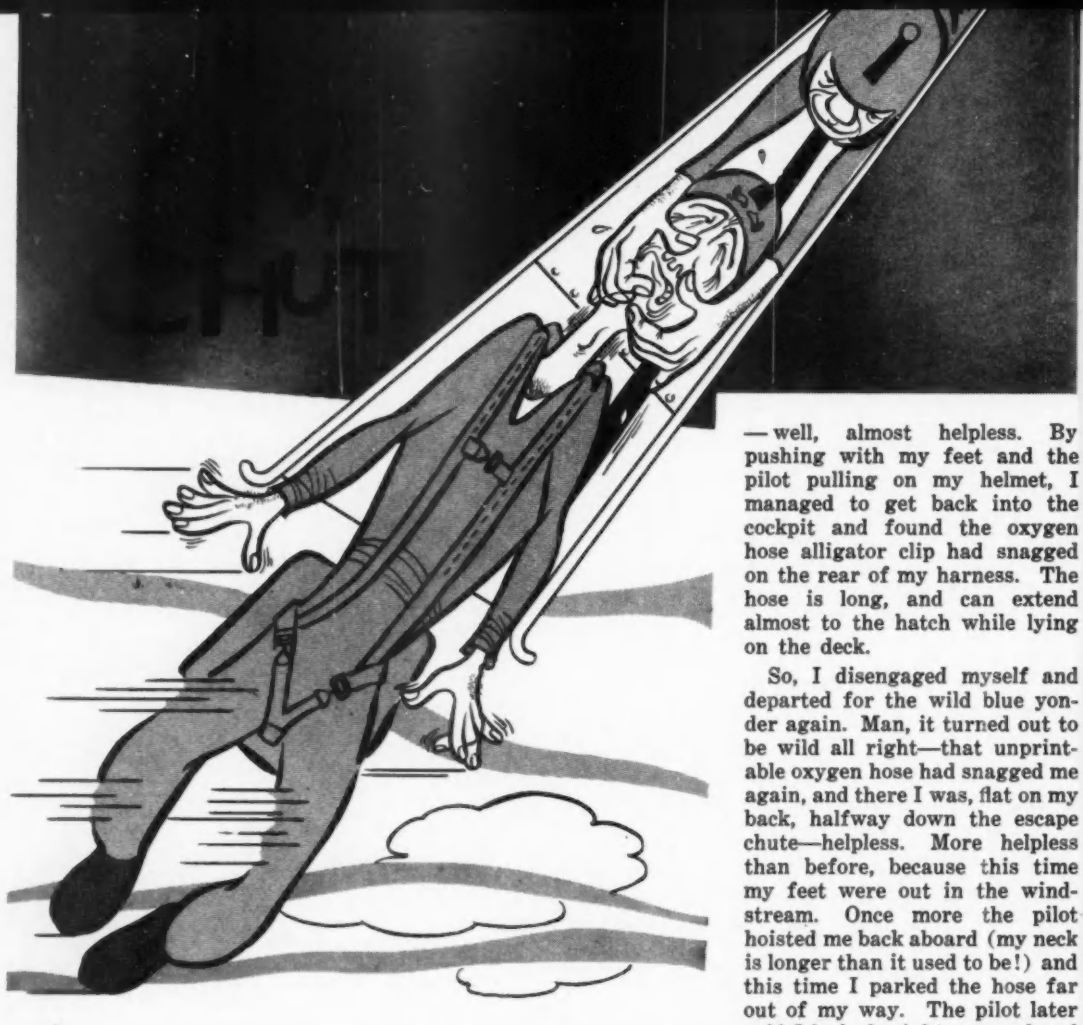
Survival Training

If a pilot or aircrewman in the water is not free of his parachute and the parachute canopy is not collapsed, helicopter rotor downwash will cause the canopy to rotate. However, the twisting action this imparts to the risers could hopelessly entangle the pilot. *This is one more very good reason for every pilot and aircrewman to know his survival equipment backwards and forwards and to be thoroughly trained in overwater survival.*

Tape For Helmets

LUMINOUS reflective tape on all protective helmets to increase detectability of downed pilots and aircrewmen is recommended by BuWeps Aviation Clothing and Survival Equipment Bul. 1-60. The tape, which is preferred to a fluorescent paint, can be easily removed when damaged and replaced with fresh tape. Among the disadvantages of the paint on helmets was that it was heat absorbing, its brilliance decreased with age and it lost its effectiveness when chipped or dirty.

Two colors of reflective tape are to be used: red for maximum visibility in daylight and silver for maximum visibility at night. The tape is available in the supply system. The Federal Stock Numbers are D-8305-656-1494 for the red tape and D-8305-558-0218 for the silver.



...AND there I was, flat on my back, half-way down the F3D escape chute—helpless.

It all began when we noticed the port gear wasn't fully up. The pilot retarded power to slow down and recycle the gear, and that's when we got a port engine fire light. We pulled the fuel pump circuit breaker and checked for smoke. No smoke but still that fire warning light. And then explosions and rumbles from the port engine.

The pilot told me it was time to go, so I sent out a "Mayday" and started to take the long slide down. Part way down the escape chute, I suddenly came to a screeching halt . . . and there I was, flat on my back, halfway down the escape chute—helpless—well, almost helpless. By pushing with my feet and the pilot pulling on my helmet, I managed to get back into the cockpit and found the oxygen hose alligator clip had snagged on the rear of my harness. The hose is long, and can extend almost to the hatch while lying on the deck.

So, I disengaged myself and departed for the wild blue yonder again. Man, it turned out to be wild all right—that unprintable oxygen hose had snagged me again, and there I was, flat on my back, halfway down the escape chute—helpless. More helpless than before, because this time my feet were out in the windstream. Once more the pilot hoisted me back aboard (my neck is longer than it used to be!) and this time I parked the hose far out of my way. The pilot later said I looked mighty pooped and my face had a brownish hue, which he attributed to lack of oxygen. I had actuated my bail-out bottle before the first slide through, and I know I was changing color from exhaustion and because I'm a big, 34-year old boy.

I went out again a third time, and this time it was very, very routine.

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Forms for writing Anymouse Reports and mailing envelopes are available in ready-rooms and line shacks. All reports are considered for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —

SPEED KILLS

MY VIP commitment completed, I made my sixth and final landing aboard our ship, an LSD. The HUS-1 had responded most satisfactorily during the entire hop and I was feeling very content and looking forward to a good shower and some hot chow.

As soon as I was chocked and reeled on the "flight deck," I went through the standard HUS shutdown procedure and sat back waiting for the rotors to slow down to rotor brake RPM. All of a sudden my copilot yelled "Fire!" over the intercom, and with no further hesitation, "ejected" himself sideways out of the aircraft.

Visions of burning magnesium filled my mind. Realizing I was sitting right on top of 8000 pounds of what amounted to solid lighter fluid, I actually started to pray. It could not have taken more than 10 seconds for me to get all the switches OFF and get out of there, but for the whole time I figured I was a dead man.

The flight deck crew and fire fighting team worked most admirably and extinguished the fire before serious damage was done so the ending may seem anticlimatic. However, the findings of the investigation were enough to warrant my anxiety.

It seems the internal APU had been pulled from the aircraft and the electrical leads were not grounded out. I had been sitting on top of a "hot" wire all day and the wires could have crossed anytime during the 3.2-hour hop. If this had happened anywhere but on the ship the Navy would probably have scratched one HUS from the roster—and possibly had to send some telegrams.

The incident was the end result of several poor situations. In the interest of efficient helo operations on an LSD, speed was emphasized. Inspection pilots were provided for preflight so that the assigned pilot could hop in the plane, engage, and take off in minimum time. Maintenance had been pushed hard for five months, and they also were extremely rushed. They were forgetful and lax in this case. The old highway slogan "Speed Kills" is true in aviation.

FLAG DAY

OUR reserve squadron had just received F9F-8Bs and I was scheduled for my first fam in the aircraft. I completed the walk around and made a mental note of the "wing, unlock flags" being up. Taking my time, I went through the cockpit check and then fired up. Taxiing out for takeoff the pace became more hurried.

The chase pilot was waiting at the end of the runway and I hurried through the remaining part of the checklist and launched. After takeoff I cleaned the airplane up and proceeded to get on climb schedule. Then it happened—while checking the plane over during the climb I glanced out at the right wing. A red flag, "five feet square" (it seemed that big anyway) hit my shocked eyeballs!

A quick check showed the same condition on the left wing. After swallowing the lump in my throat, I stopped the climb and leveled out at 20 thousand. "Chase" came up alongside and we started talking the thing over. Attempting to push the wing lock lever into lock position was unsuccessful. We decided to dump wing fuel. Then, after burning down the internal load I turned on the emergncy hydraulic pump, lowered the gear and then the flaps. All the while I was keyed up to make that quick exit and while lowering wheels and flaps I kept an alert eye on that "crack" in the wing.

A long straight-in approach to the field seemed to be best as far as keeping the air loads balanced. The field had been notified and the arresting gear was in battery position, along with all other emergency equipment. So, feeling like I was walking on eggs, I eased the machine down to the runway.

Back on the line I finally mustered enough strength to get out of the cockpit, but not before I added a new item to my checklist: get the head out and unlocked around airplanes and secondly, don't rush—let "chase" sit a while until you are calmly, confident you are ready.

I no longer think, while listening to the safety officer's lectures, that it can't happen to me, because it *did*.

Have a problem, or a question? Send it to **headmouse** he'll do his best to help.

Hydraulic/Pitot/Static Cross-Up

Dear Headmouse:

I turned up an F9F-8T after it had received an engine change during major check. When the engine RPM had built up to about 20% I noticed the rate-of-climb, altimeter, and airspeed indicators all filling up with red hydraulic fluid. I immediately shut the engine down and investigated. I found the static vent line and the flapperette line had been interchanged on the port bulkhead of the plenum chamber. This appears to be strictly a case of Murphy's Law.

ANYMOUSE

► A sharp eye may have saved you an eye—This the second reported instance of this happening in the -8T. In the first case an instrument exploded shattering glass in the face of the mechanic (Murphy's Law, P41 of Jan '58 APPROACH). To lessen the possibility of cross-connecting lines color coding should be applied to lines and connections. Further a test of the pitot-static system is required in accordance with Instrument Bul. 29-46 and the HIR on each major check, and before turn-up (see "Pitot-Static System Water Removal," page 40). A good policy is to break the flapperette line at the quick-disconnect instead of at the fitting at fuselage station 284.

Very resp'y,
HEADMOUSE

'Speak Up'

Dear Headmouse:

All too often, a legal investigation is ordered because of an accident report. In fact, endorsements to AARs often indicate, and properly so, whether such an investigation is or is not being ordered.

The situation has set me to wondering. I feel now that if I were to have an accident, *I would not submit a pilot's statement.* Why should I make a statement that might possibly incriminate me?

I know that AARs are supposed to be beyond the reach of legal boards but everyone knows that the people who convene or conduct legal investigations are the same people that we sit in the wardroom with and discuss accidents with, as a matter of course. They also have access to AARs so it is a simple matter to put the AAR statement maker under oath and get the same

POWER PLANT OPERATION TERMINOLOGY

Dear Headmouse:

We are confused by the terms, MRT and METO. What is the straight dope?

JAYGEE

► A recent letter from BuWeps states Military specification MIL-E-5007B of 17 Oct 1958, MIL-E-8594 of 3 Sept 1954 and MIL-E-25110 of 7 Feb 1955 pertain to aircraft engines and contain basic and official power plant terminology. Deviations in rating terminology from these specifications may at times be granted for specific engines, therefore the approved engine model specifications shall be the authoritative source in such cases.

There exist many and varied differences in power plant terminology between flight manuals. Many of the terms that appear in the flight handbooks are not consistent with the nomenclature and terms of the Mil Specs mentioned.

In order to standardize terms pertaining to power plant operation in the flight manuals it is requested that terminology and terms listed below be used where applicable and that necessary changes be made in the next scheduled revision to the flight manual:

Official Term: Takeoff or Takeoff (Wet), Takeoff (Augmented)

a. TAKEOFF is used almost exclusively for engines driving propellers. The time limit for use is usually 5 minutes.

b. Helicopters with shaft drive engines seldom use this rating.

c. When water or water/alcohol injection is used optionally, two takeoff ratings should be given. For ratings where water is employed, specify (wet) for piston engines, and (augmented) for turbo-prop engines for clarification.

Minimum Augmented and Maximum Non-Augmented

a. These terms are used for new categories of turbojet afterburner engines mainly where a

information from him that he has given to the privileged accident board.

The same reasoning as above makes me wonder if I would want to make a statement after observing an accident . . . why should I put some other poor pilot on a possible spot by telling what I saw?

It is a sad state of affairs.

PERPLEXED MOUSE

► Aside from the mountain of paper work required, the state of affairs is not sad at all. See "Speak Up," March APPROACH, page 10.

All legal investigations are convened and conducted in accordance with the Naval Supplement to The Manual for Courts Martial. If you are not familiar with the stringent safeguards provided for parties and witnesses in investigations, read section 0304, 0305 and 0306 of the Supplement.

Conceding your points about

wardroom conversation and administrative access to legally inaccessible documents, the fact remains that the record of proceedings of a legal investigation can reflect only what is revealed during the course of *that* investigation with all of its legal hurdles.

It makes no difference whether the matter under investigation is mayhem, expectorating on the sidewalk or an aircraft accident —the protection is always there and is the same for all.

There is no way that the remarks of a pilot, if they are incriminating, can get into the record of a legal investigation against his wishes—regardless of any statements he may have made to an AAR Board.

And if you are just an eyeball witness who is worrying about ratting on his buddy, we can't help you—that is a matter between you and your conscience.

Very resp'y,
HEADMOUSE

modulated (multi-position) after-burner is employed.

b. The term MAXIMUM NON-AUGMENTED also applies to afterburner engines which have a special MAXIMUM rating out of the after-burner regime.

c. When either of these ratings are approved for 15 or 30 minutes, the more usual terms MILITARY and MAXIMUM will substitute.

Maximum or Maximum (Afterburner)

a. This term is used for turbojet engines and the time limit for use is usually 15 minutes.

b. The term CRT (combat rated thrust) is sometimes used for the MAXIMUM (AFTERBURNER) thrust but this is not the official term and should not be used. Where afterburner is employed use MAXIMUM (AFTERBURNER) for clarity. NOTE: The only official reference to COMBAT RATED (POWER) is contained in MIL-E-5445 and it refers to the former WAR EMERGENCY RATING for reciprocating engines.

Military

a. This term applies to all types of engines and the time limit applicable to its use is usually 30 minutes.

b. The abbreviation MRT (military rated thrust) is sometimes used to signify Military Thrust but "MRT" is not the official term, as it could be used erroneously for maximum rated thrust when abbreviated. Also, the term "rated" is only used for specific conditions such as thrust at sea level or at a specified altitude.

Normal or Normal (Maximum Continuous)

a. This term applies to all types of engines, is the official term and there is no defined time limit for its use.

b. The abbreviation NRT is sometimes used to indicate Normal Rated Thrust.

c. The comparable limit for civil engines is called MAXIMUM CONTINUOUS. A superseded term for civil engines is METO (Maximum except takeoff). These terms are sometimes used interchangeably with the term NORMAL. Although all three appear in specification MIL-M-7700A, the term most used is NORMAL.

Very resp'y
HEADMOUSE

Support Equipment

Round Up a

Many costly accidents are due to the shortage and d

ment. Today there is a vital need to round up, r

THE condition and availability of proper equipment to perform the maintenance function on our modern aircraft has a direct bearing on the number of aircraft ready for flight, and on the numbers available to maintain a "set pace" during sustained operating periods.

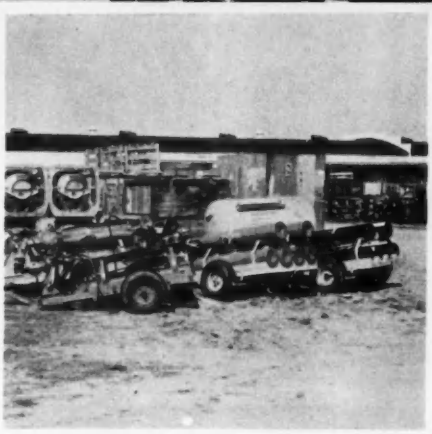
In the absence of adequate quantities of the latest proven equipments for the performance of aircraft maintenance, staff members of ComNavAirLant over the past two years have been forwarding requirements to our technical bureaus and the Aviation Supply Office. Many new equipment contracts have been satisfied and the equipment is now in use. However, due to budgetary limitations and lengthy contract lead times many of our support equipment items remain in a critical supply stock status.

In the meantime a general house cleaning program was initiated throughout the Fleet for the return of critical supply stock status equipment for repair and subsequent re-issue. ComNavAirLant states that it is essential that this program continue, following FASRON disestablishments, by the naval air station Class "C" aircraft maintenance departments in the direct support of fleet activities.

Inspections at various activities revealed aircraft ground support equipment deficiencies as follows:

► Excessive losses of aircraft inventory items, intake duct covers, jury struts, control locks and landing gear down-locks.

► Aircraft tow tractors being operated with



pand Repair

ortand disrepair of aircraft ground support equip-

roun, repair and to strictly account for same.

deficient brakes, engine malfunctions, fuel/oil leaks, disconnected engine governors and malfunctioning gear shift mechanisms.

► Aircraft tow tractor bell housings broken as the result of starter engagement with engine running.

► Many gas turbine compressor air start units changed; considered inoperable for minor reasons, such as dirty fuel filters, improved minor adjustments, gasket leakage. These units are arriving at the designated O&R for overhaul.

► Aircraft jacks rusty, inoperable and unsafe due to the lack of routine maintenance.

► Many aircraft tow bars and wheel chocks broken, causing jet engine foreign object damage, injury to personnel and damage to aircraft.

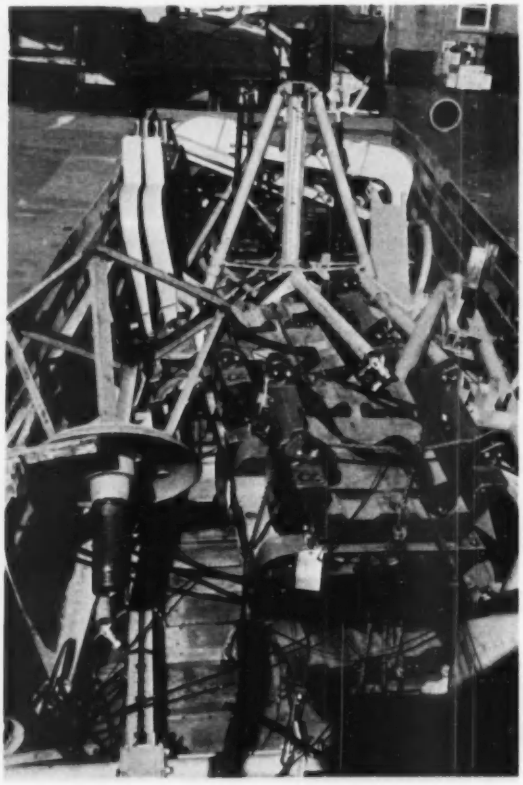
► Internal combustion engines installed in hydraulic test stands, air compressors and mobile electric power plants being operated on high octane AVGAS resulting in markedly reduced engine life.

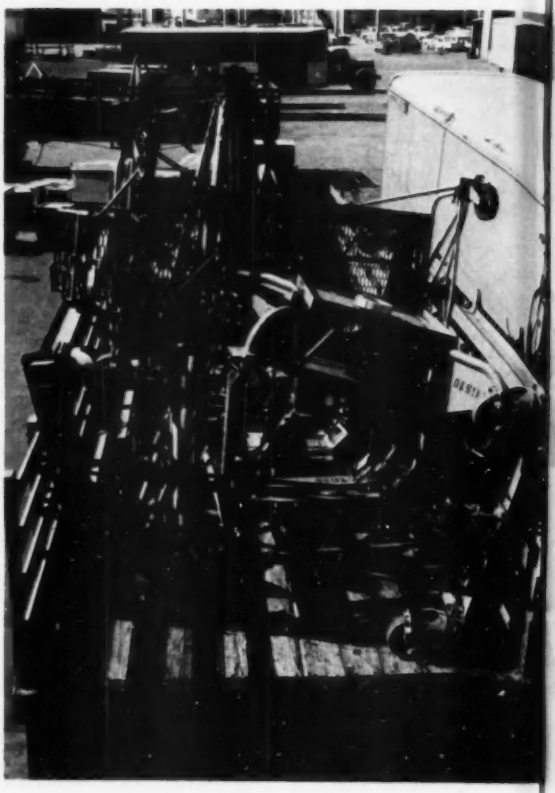
► Mobile electric power plants being operated below frequency and over voltage outputs resulting in damage to aircraft circuits and instruments.

► O&R customer service assistance not requested when equipment repairs are beyond capabilities, or when replacement equipment not available in the supply system.

► Hydraulic test stands contaminated, inducing contamination into aircraft systems. This is extremely dangerous with hydraulic power control aircraft.

Slipshod Shipping Speeds Scrapping





► Liquid oxygen handling equipment dirty, oily and contaminated.

► Equipment returned for repairs with the following items missing; wheels, tires, gages, valves, engine accessories, some units beyond repair possibilities.

► Equipment cooling systems not properly winterized.

► Mobile self propelled equipment being driven at high speeds on ramps and in aircraft parking areas.

► Gas turbine compressor air start hoses, fuel and oil truck servicing hoses, mobile electric power plant power cables improperly stowed and dragging on concrete ramps and streets.

► Engine pre-oiling and preservation equipment contaminated.

Those items which reflect improper unit practices pertaining to maintenance, servicing, care and handling, or accountability merits command attention to insure correction and future guidance of units involved. Those items which pertain to design and engineering deficiencies should be reported promptly to material offices with appropriate recommendations.

ComNavAirLant suggests the following improvements which will contribute to a high degree of aircraft readiness:

● Initiate strict custodial procedures and frequent inventories to minimize losses.

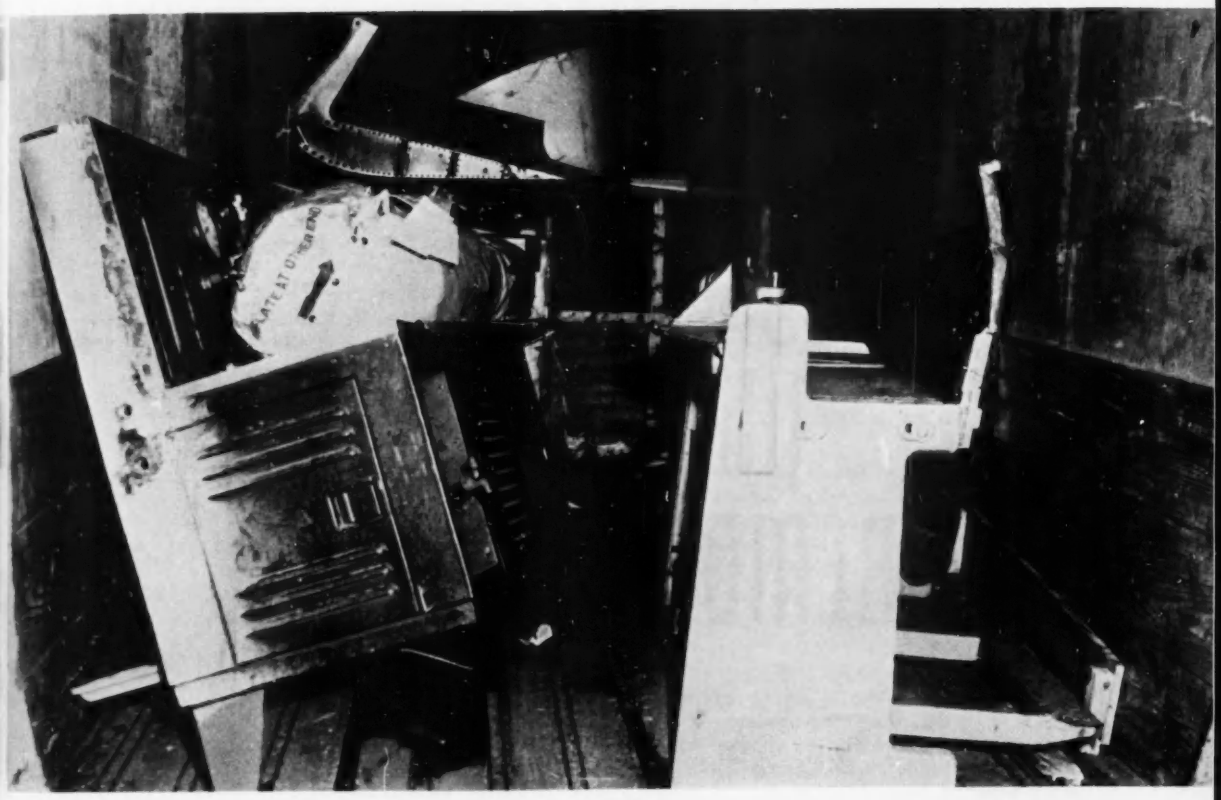
● Take prompt measures to eliminate acts of negligence.

● Combine a comprehensive training program with the aircraft training program to install pride of ownership and thorough mechanical understanding and operating limitations of equipment.

● Make frequent inspections and initiate a preventive maintenance program to reduce "down" time on equipment.

● Request contractors technical service repre-

# of Supplies Sorely needed for Support



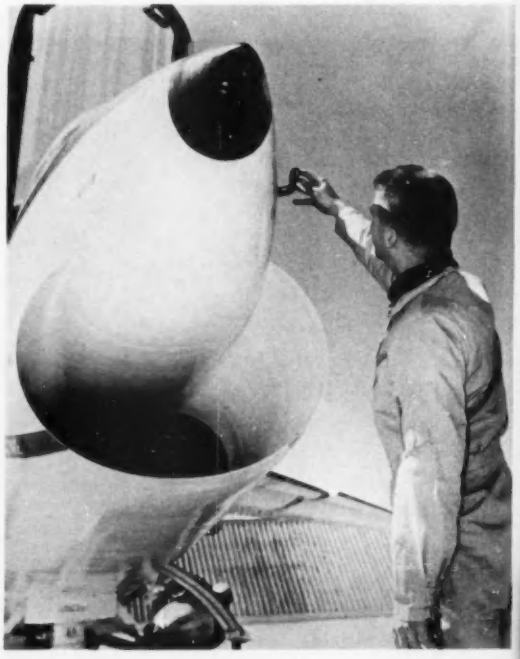
sentative assistance from ComNavAirLant or local ComFAirs. (NAESU engineers' capabilities and services are not limited to their parent company's product.)

● Screen your local area periodically for equipment in excess, or requiring repairs. Repair as necessary and return equipment to RFI supply stock.

● Initiate a program establishing standards for rejection of malfunctioning self propelled mobile equipments to eliminate aircraft ground accident, personnel injury/fatality potentials.

Much more emphasis must be placed on the proper maintenance, damage prevention, and accountability of equipment so vital to the readiness of our aircraft. Although much has been accomplished in the recent past to improve our position in these respects, it is obvious that continued unrelenting efforts by all hands must be insisted upon. ●

PITOT STATIC SYSTEM WATER REMOVAL



by J. M. SMITH, FUR Analyst, Naval Air Technical Services Facility

THE article "Piping in the Wind" in the February 1960 issue of APPROACH covered thoroughly the care of the pitot tube and static vents. However, it is the opinion of this writer that the method to be used for the removal of water and other debris from the pitot-static system is also of vital importance. A review of accident, incident and other type reports indicates that on many occasions after water and other foreign matter had been found in the system, mechanics removed same without due regard to instructions outlined in the various aircraft handbooks and manuals covering this procedure.

The back of an airspeed or rate-of-climb indicator and the altimeter, probably the oldest instrument of all, have the words "DO NOT BLOW IN TUBES" inscribed on the case. This is a warning against inducing pressures into the instrument greater than is required to operate the delicate mechanism inside the case. Damaged instrument reports indicate many maintenance personnel are not aware of the proper system maintenance necessary to insure correct and reliable indicators. Some reports reveal that these personnel involved believe that they induced air pressure into the system in the wrong direction, resulting in blowing out the face of the instruments and rupturing the diaphragms of the delicate mechanism. The statement that air was induced in the wrong direction is erroneous. The error being that the instruments were *not disconnected from the system as the first step of the water and debris removal procedure.*

The number of indicators per aircraft that can be damaged thusly depends on the model aircraft involved. In the case of an F9F-6, three instruments would be involved while on a P5M the total could be 10 or 12.

Only clean dry filtered air should be circulated through the complete pitot-static system after all the instruments have been disconnected and both the pitot and static line drain cap have been removed. Air should also be circulated through each static vent of the system being very carefu!

not to include the cabin pressurization system static vent as part of the pitot-static system.

After all lines have been cleaned the drain caps should be replaced and all instruments reconnected. A pressure check of the entire system should then be made using an approved field test set or testing device. This pressure check is of the utmost importance as a slight leak will result in erroneous indications on ensuing flights. These erroneous indications will be of a greater magnitude on installations involving the pressurized cockpits.

Pilots and maintenance personnel should check the operation of the pitot tube heater during their preflight inspections. Such a check could possibly prevent serious consequences if the aircraft was scheduled for operations at high altitude or in icing conditions at any altitude. For mechanics this check should include a touch test of the pitot tube with the heater switch in the cockpit ON—pilots usually check for an amperage drop in the ammeter readings.

To summarize the proper procedure for water and debris removal from the pitot-static system the following steps are outlined for possible use by maintenance personnel responsible for the system maintenance.

Step 1—Disconnect all altimeters, airspeed and rate-of-climb indicators on the aircraft. Disconnect the line or lines from the pitot or pitot-static tubes.

Step 2—Remove all pitot and static drain caps in the system using two wrenches to avoid damage to the lines. Refer to the applicable aircraft handbook if the location of all drain caps is not positively known.

Step 3—Circulate a stream of clean dry filtered air at medium pressure through the complete system and into each static vent being careful *not to include the cabin pressurization system static vent.* Be certain that air is flowing from the exit end of each line.

Step 4—Inspect all static vents and the pitot tube water removal drain holes for damage and evidence of foreign matter and obstructions. Check all low points in the lines for possible cracks due to previous icing of water in the lines.

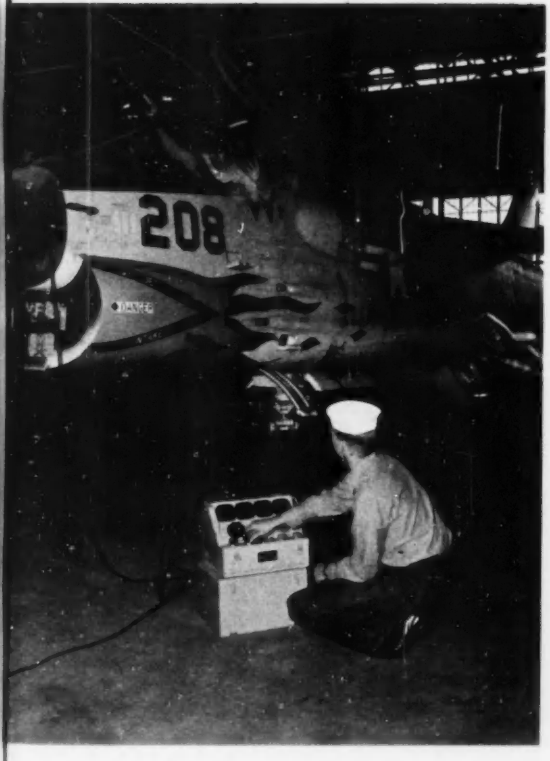
Step 5—Replace and properly secure all system drain caps using two wrenches to avoid damaging the lines.

Step 6—Reconnect all instruments paying particular attention to the proper connection of lines to respective pressure and static ports on the indicators, this item being the subject of many past MURPHY'S. Be extremely careful to avoid kinking or twisting hoses and tubing. Insure that all connections are properly tightened to avoid leakage.

Step 7—Using a field test set or other approved tester, thoroughly check system for proper operation, leakage and correct indication, including the proper operation of the pitot tube heater circuit. It is believed that the compliance with these elementary procedures will greatly increase the reliability of the pitot-static system and prevent unnecessary damage to many instruments.

While the pitot-static system is relatively simple when compared to the more complex systems its maintenance should not be considered a minor task and consequently assigned to the less experienced personnel. It should be treated with as much care and supervision as a more complicated system. Remember, in the event of electrical or engine failure or malfunction a pilot will always need these primary flight indicators to effect a successful landing if suitable conditions prevail. ●

It is especially important whenever pitot-static lines are disconnected that a functional test follows reconnection of the lines.—*Aircraft Instrument Bul. 24-46*



NOTES AND COMMENTS ON MAINTENANCE

JACKS—Jacks that are used infrequently require certain attention because they are a very important tool when they are needed. To keep your jacks in top operating condition, pump them up at least monthly to full extension, wipe the piston clean and then lower. Store them out of weather and protect them from the elements.—*NSC Safety Newsletter*

Flexible air ducting makes good jack extension cover.

WHISTLE MEN—Hangar deck personnel should not move aircraft when the noise level is such that whistles cannot be heard, except when they have the pilot's or plane captain's attention so that he may be positively controlled by visual signals.

AIRCRAFT JACKS—A recent survey by ComFAirSDiego has proven that proper distribution of available Jacks can do much to alleviate the shortage of aircraft jacks. As an example, it was found that some squadrons were using 10-ton axle Jacks when 5-ton jacks would be suitable. Since a 5-ton Jack is not a substitute for 10-ton Jacks, improper distribution of this type can cause an unnecessary shortage.

Naval Air Technical Services Facility Booklet TSF-EQ/66 of 18 December 1959 is considered an excellent source of information concerning aircraft Jacks application.—*Logistic Support Info Notice 240*

SPARE PARTS SUPPORT OF GROUND HANDLING EQUIPMENTS—A complete range of spare parts to support the following items of Ground Handling Equipment are available in the supply system and should be requisitioned through normal supply channels if required:

Engine Removal

Trailer—Engine Removal	Model 4000A
Trailer—Transportation	Model 3000
Trailer—Transportation	Model 3000A
Trailer—Transportation	Model 3000B
Hoist—Monorail	Model 4600A
Work-Stand	Model 3110
Hoist—Monorail	Model 4630
Work-Stand	Model 3100
Work-Stand	Model 3100A

Aircraft Hydraulic Jacks

Spare Parts and Kits are now available for every aircraft jack manufactured by the following contractors:

Malabar Manufacturing Company
Regent Manufacturing Company
Smith-Nelson Company (Sancor Corp.)

The New Air Force Standard Type Jacks

A complete range of spare parts and kits are under procurement. Delivery commenced 17 March—*Logistic Support Info Note 236*

TOWING TIP—One NAS reports it attaches *electric blinker* type construction lights to be wings of aircraft being towed at night. This is done by means of rubber suction cups. Two purposes are served here. Aircraft batteries are saved and the mule driver is alerted because he has to place the lights. Since this idea was incorporated, no towing ground accidents have occurred.

LIQUID OXYGEN

Reports of contaminated liquid oxygen have stirred up quite a bit of action in the local areas lately. Close scrutiny of squadron operations and safety bulletins indicates that we're not complying with current safety regulations in the handling and processing of liquid oxygen, and some of us may soon lose our heads (and aircraft) if we don't take some corrective action.

May we reiterate that "smelly" oxygen in the aircraft system is reason enough to ground the aircraft, or if airborne, to return to base ASAP. So much for the pilot and the proper course of action for him to take upon discovery of contaminated oxygen.

The most frequent cause of oxygen contamination is improper servicing procedures by ground crews who take care of our "birds." These deviations from established safety regulations generally result from good intentions bent on expediting turn-around time so we can get in a little more flight time.

Some of the more recently reported violations of oxygen handling SOP's are:

a. No caps on hoses on aircraft servicing trailers. (This will result in a frost on the nozzle like that on a refrigerator that needs defrosting. This frost absorbs all sorts of smells and passes them into the aircraft, and there is also a cumulative contaminant effect on the oxygen in the trailer.)

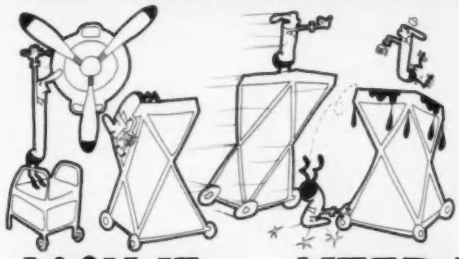
b. Ventlines over asphalt. Good for explosions.

c. Aircraft being serviced with liquid oxygen while parked on dirty ramps. (It's best to move the "bird" if the area has fuel or oil on the ramp. If the "bird" can't be moved, use clean, metallic drip pans to catch overflow from vent lines.)

d. Ground crewmen not wearing protective gloves, face masks, or proper clothing. (If the oxygen explodes on contact with fuel, oil, or even dust while aircraft is being serviced, we'll lose these crewmen as well as the plane.) The protective clothing, hoods, shoes, etc., above are standard issue items and each squadron rates four sets.

Remember—dress well and be cautious with liquid oxygen. (For more information on handling and contamination see "Handle With Care," page 14).—*"Av Safety Bulletin" USMCAS El Toro*

USE THE RIGHT STAND



LOCK IT DOWN KEEP IT CLEAN

PROPER PURGING PRESSURES—While purging the liquid oxygen system of FJ-4B the purging apparatus began to smoke. The operator shut off the oxygen supply and seconds later the apparatus exploded.

The accident was caused by a short circuit in the electrical system and an oxygen leak in the oxygen purging apparatus at one of the fittings in the forward part of the machine.

The accident board's appraisal of the damage sustained by the unit evidenced characteristics identical to those found in four other units which have been damaged as a result of overheating. In each of these four cases, overheating was conclusively determined to have resulted from the failure of the operator to maintain sufficient pressure and volume of gas. Operating instructions for the unit, state, "A pressure of 30 psi or above must be maintained to assure a sufficient volume of gas to properly purge the liquid oxygen system and to protect the machine from overheating and consequent damage."

Considering the nature of the damage sustained and past experience with this unit, it is believed that the insulation was burned off of the electrical wires in the unit due to escaping hot gases caused, in turn, by operating the unit below 30 psi.

It was recommended that personnel operating the units be familiar with, and follow, the operating instructions. Operating instructions provided with each unit contain a note stressing that the teflon seals would start to deteriorate at temperatures of 300°F, and that at no time should the temperature reach or exceed 300°F. It was also recommended that 250°F (plus or minus 20°) at 50 psi be maintained at the pilot's outlet. However, there was no precautionary information provided to indicate the hazards involved in operating the unit at pressures below 30 psi.

WEATHER-CHECKING OF FUEL HOSES—Concern has been expressed by service activities about weather checking of fuel hoses. Here's how we look at it:

On A3D aircraft probably the most common report of weather check is on the main fuel transfer line from the forward to aft fuel cell. The main cause of fuel hose weather-checking is exposure to high concentrations of ozone or smog. For this reason some areas of operation have had more trouble with weather-checking than others. Although weather-checking is not desirable from a morale standpoint, nevertheless, the material integrity and service life of the fuel hose is affected little. If the weather-checking is down to the nylon cord and the cord has not been disturbed—that is frayed or cut—a coat of Vanderbilt Blackout coating or U.S.R. Vinyl-Buna cement will protect the hose from further cracking (and the fuel hose service life will not be affected). However, if the nylon cord layer has been disturbed, the fuel hose should be rejected at the earliest possible date. Unless damage can be seen to the rayon cord layer, concern is unwarranted.—*Douglas Aircraft "Service Information Summary"*

SPLIT FLAP—During takeoff from FCLP, an S2F experienced a split flap condition. The pilots were able to control the aircraft until sufficient speed and altitude were gained to raise the flaps by increments to the full up position. Extreme physical exertion was necessary to maintain control during the climbout. It is considered that quick deduction of the problem and positive action averted an accident. A routine no-flap landing was made following the incident.

ASC 275 was incorporated prior to acceptance. During acceptance check, the appropriate lubrication and installation check was performed on the wing flap hinge bolts. During flight the nut backed off the port hinge bolt allowing the bolt to move forward a sufficient amount to permit a split flap condition. It is assumed that the cotter pin sheared resulting in the loss of the nut. The possibility of this occurring in the future should be eliminated by ASC 275B which replaces the present cotter pin with a high shear steel clip. ASC 275B was received in the squadron on the same day the incident occurred.

Although this emergency did not result in an accident, it is reasonable to assume that a moment of indecision or an incorrect evaluation of the problem could have resulted in the loss of an aircraft. *Contributed by W. V. Whidden, CO, VS-32*

HYDRAULIC OIL FUMES—A recent incident of hydraulic oil fumes entering the cabin of a WV during flight revealed it is possible for the No. 1 or No. 4 hydraulic pump control valve to leak hydraulic fluid into its corresponding cabin supercharger inlet ducting while in flight. This situation allows hydraulic fluid to enter the cabin in a highly explosive, vaporized form.

In the event fumes are detected in the WV/R7V cabin, in flight, which are suspected to be from a hydraulic oil source, the following steps should be taken immediately: (Most of the items on this checklist would be applicable to any aircraft, but of course should be specifically checked for applicability to your model).

• Notify all occupants	NO SMOKING
• Radar	STANDBY
• Actuate radios & electrical equipment	(FOR EMERGENCY USE ONLY)
• 1 and 4 hydraulic pumps	OFF
• Heaters and all fans	OFF
• Auto pilot	OFF
• Aux Control Boosters	OFF
• Emergency descent	(IF NECESSARY)
• Aux Vent knob (Safe altitude)	FULL OPEN
• Cabin superchargers	DISCONNECT
• Smoke removal	(IF NECESSARY)

Improper Parts, Service, Workmanship Source of Engine Troubles

Findings, conclusions and recommendations from Selected Engine Disassembly and Inspection Reports

J57-P16 Engine afterburner nozzle actuating cylinders were removed as a result of piston seizure. A Disassembly Inspection Report was requested to determine the identity of the substance which caused the seizure.

Findings: Chemical and infrared spectrophotometric analysis indicated the substance to be a mixture of the decomposed products of synthetic jet engine lubricating oil MIL-0-7808.

Conclusions: The breakdown of the synthetic jet engine lubricating oil under excessive heat caused gumming on the cylinder walls and pistons, resulting in piston seizure.

Recommendations: Operating and maintenance personnel should assure that lubricating oils are not used for preservation or lubrication of the air actuated systems of the afterburner. Actuating cylinders should be treated internally in accordance with NavAer 02B-10ADE-502 Section V using only anti-seizure compound MIL-A-25553 in areas indicated.

Model 43E60-511 Propeller: Removed due to inability to unreverse.

Findings: Propeller would not fully reverse against the mechanical stops, but would unreverse from this position. Propeller when manually turned against the reverse stops would not unreverse. Oil flow in the reverse pitch position was 25 quarts per minute. Reverse stop adjustment sleeve was reset to give correct oil flow and propeller reverse and unreverse action was satisfactory.

Propeller blade angle was 76.5° in feather and 22.3° in reverse. The feather stop ring was four ring teeth and the reverse stop ring one tooth from correct locations.

Conclusions: Improper propeller action resulted from incorrect setting of the adjusting sleeve of the low pitch stop assembly allowing an excessive oil flow and low differential pressure across the piston during reversing and unreversing operation. The dome was disassembled and reassembled with the feather and reverse pitch stops incorrectly indexed subsequent to overhaul.

Recommendations: Low pitch stop assembly settings should not be disturbed during dome desludging. Adjustments should be made only by qualified personnel employing flow test equipment. Activities performing extensive dome and low pitch stop assembly rework or adjustment should stress the importance of inspection for quality control by both production and quality control division personnel.

J57-P8 Engine removed due to high operating time.

Findings: Six combustion chambers were cracked adjacent to the cross-over tubes. The turbine front bearing had failed and the bearing oil pressure tube was distorted and rubbed on the forward end. The oil transfer elbow locating pin revealed signs of moderate wear.

Conclusion: The front turbine bearing failure resulted from oil starvation. Oil starvation was caused by failure to properly install the oil pressure tube in the oil pressure tube adapter. The possibility exists that the oil pressure tube was improperly installed upon incorporation of Engine Bul. 385.

Recommendations: Particular attention should be given to the proper installation of the oil pressure tube in the adapter upon installation of No. 5 bearing support. Procedures for proper installation of the oil pressure tube are contained in the J57 Engine Handbook of Overhaul Instructions NavAer 02B-10ADC-503 section VIII. Installation procedures are amplified to insure proper reassembly of the oil pressure tube in ComNavAirPac msg. 120134Z of March 60 and/or ComNavAirLant Aircraft Technical Bulletins A3D No. 96; F8U No. 134; and F4D No. 141.

J65-W16A Engine removed and submitted to overhaul due to engine seizure following vibration.

Findings: The rear main bearing had failed. The O-ring seal for the rear main bearing oil metering valve was improperly installed and blocked the oil passage to the metering valve. The oil passage to the rear main bearing oil inlet tube was blocked by a plastic material. The plastic materials found in the engine oil sample and rear main bearing liner were similar to the materials of plastic hammers.

Conclusion: It was determined that the misinstallation of the oil metering valve O-ring caused the oil starvation which resulted in the failure of the rear main bearing.

Recommendations: During the inspection of the oil metering valves extreme caution should be exercised to insure proper installation of the O-ring seals. Reassembly procedures are outlined in J65 Engine Bul. 265 to assure proper O-ring seal location. It is further recommended that every effort be employed to assure that engine oil does not become contaminated.

MINIATURE GREASE FITTINGS—The NAS 516-1 flush type lubricator is a small inconspicuous grease fitting that resembles the end of a ⅛-inch pin with a small indentation in the center. Its use has permitted design engineers to effectively reduce weight and to provide an efficient means of lubrication where grease replenishment would otherwise be a difficult problem.

Several features favor the NAS 516-1 fitting. Better component strength/weight ratios result from their use because the small reamed hole into which this tiny fitting is pressed removes less material and has less stress raising potential than the larger threaded hole that designers must provide for other fittings. The reduction in stress permits a proportionate reduction in component weight without loss of strength.

Flush fittings such as these do not impose clearance problems (See "Murphy's Law," page 47) and for this reason they are widely used on moving parts. Some sealed bearings that would otherwise require hand packing have been provided with NAS 516-1 fittings, making it a simple task to replenish the lubricant whenever it is needed. The fittings are so small, however, that they are easily overlooked (see Figure 1) and some bearings have starved for lubrication and failed for this reason.

For example, a Lockheed *Starliner* aileron push-pull rod had to be replaced when one of its bearings seized due to lack of lubrication. The bearing was in an area which had been cleaned frequently. Either the flush fitting had been bypassed in the course of regular lubrication or the grease was inadvertently washed out of the bearing when the area was cleaned with steam or solvent.

It is a good idea to shield bearings and bushings from steam or solvent cleaning and solvent run-off where practicable, and clean grease and dirt off the bearing by wiping with a cloth. Care should be taken that steam or solvent spray is never aimed directly at a bearing or bushing.

Details of the NAS 516-1 fitting can be seen in Figure 1. Grease is injected into these flush lubricators through an adapter nozzle fitted to a grease gun. This nozzle must be pressed firmly and squarely into the recessed opening of the fitting in order to provide a good connection and open passageway for the grease. There are many possible grease gun configurations, one of which is shown in Figure 2. The quick-change coupler allows the mechanic to quickly adapt the gun to either the standard hydraulic or the flush type of lubrication fitting. Because of the low delivery rate, it is recommended that a gun of the type shown in Figure 2 be used to lubricate NAS 516-1 fittings. The operator has complete control of the pressure and the rate of discharge so there is little chance that he will accidentally build up sufficient pressure under the pressed-in fitting to un-seat it, or inject grease into sealed bearings faster than the seals can bleed off the pressure.

Periodic lubrication alone may not consistently safeguard all bearings, however. Whenever bearings or their lubricants have been exposed to contamination by oil, solvents, water, or other foreign fluids, they should be relubricated at the earliest possible opportunity. Lubrication not only replenishes the bearing lubricant, but it serves to flush out contaminated grease and water. *Lockheed "Field Service Digest"*

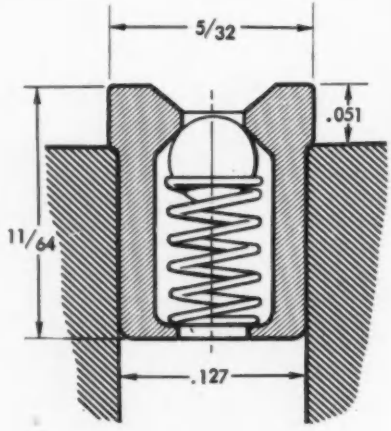


Fig. 1 Cross-section detail of NAS 516-1 fitting

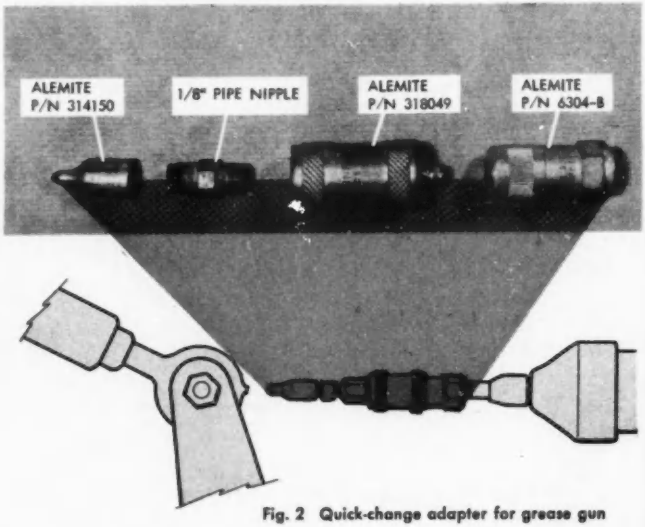
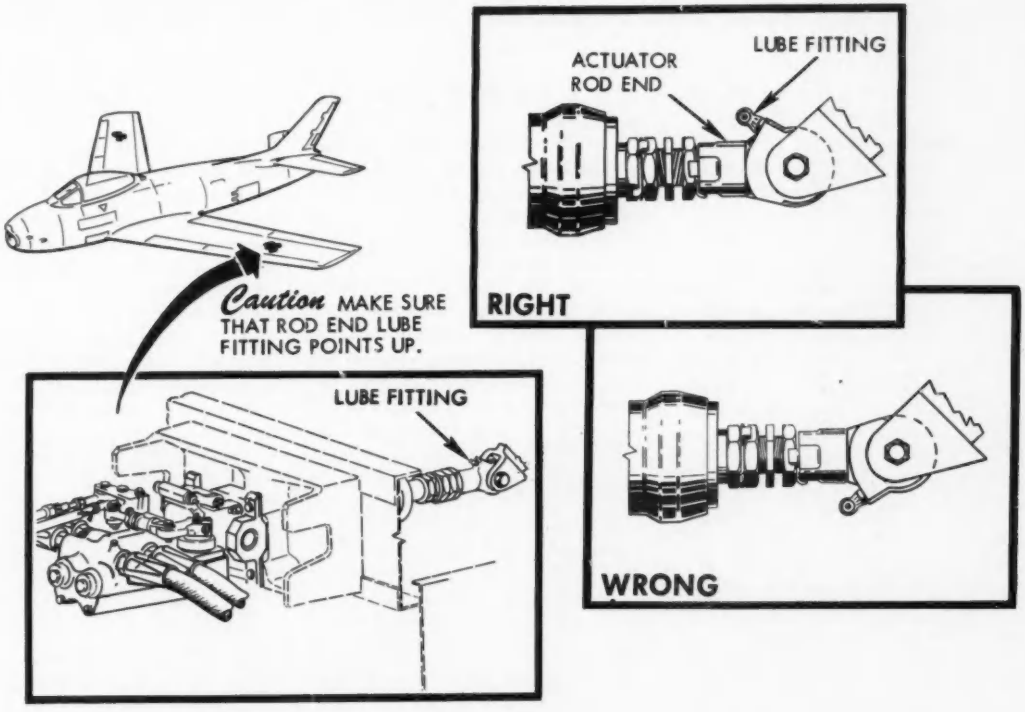


Fig. 2 Quick-change adapter for grease gun

MURPHY'S LAW*



During a preflight check of an FJ-3, it was found that the lubrication fitting on the aileron flight control hydraulic actuator rod end assembly Part No. 187-58792-5 was binding on the outboard wing lower close-out door Part No. 181-14722.

It was determined by the reporting activity that the rod end assembly had been inadvertently installed with the lubrication fitting pointing down instead of up. It was noted that the rod end assembly could be installed with equal ease in either manner.

To clarify the installation of the rod end assembly, a caution note will be added to the removal and installation instructions for the subject actuator during the next scheduled revision of the FJ-3 HMI (AN 01-60JKC-2). Until the revision pages are available in the field, it is requested that maintenance people add the caution note shown above to figure 2-65, page 2-141, of the 1 November 1956 issue of the FJ-3 Handbook of Maintenance Instructions (AN 01-60JKC-2).—*NAA "Service News"*

*If an aircraft part can be installed incorrectly, someone will install it that way!

CLIPBOARD

Drugs

SELF-MEDICATION or the taking of medicines in any form by flying personnel without medical supervision is extremely hazardous. Even simple remedies which are obtainable without prescription, such as aspirin, anti-histamines, cold tablets, cough mixtures, laxatives, tranquilizers and the like, may seriously impair the fine coordination and concentration required in flight.

A standard rule for flying personnel should be: Take no pills or medicine unless prescribed or approved by the flight surgeon.

—OpNavInst 3740.7, 25 June 57

Two-Way Street

FLIGHT personnel sometimes wonder what action, if any, is taken against FAA personnel who find themselves on the wrong side of the street in a violation. Such matters are always followed up and action taken as required by the circumstances. The following excerpt from a letter received from an Air Carrier Safety Inspector of the FAA points this up:

"Investigation of the incident reveals that the facts described in the TWA captain's letter are basically correct. We have been advised by our Air Traffic Control Division that an error was made at the Center which resulted in the air traffic confliction. In addition, we have been informed that disciplinary action has been initiated against the operator involved.

"We sincerely regret the circumstances which are associated with this air traffic incident."—*TWA "Flite Facts"*

NAFEC Evaluations

A NEW attempt to find a satisfactory solution to the "black hole" —that disconcerting runway area just beyond the approach lights—is being made at FAA's National Aviation Facilities Experimental Center, Atlantic City, N. J. Experiments are being conducted with various lighting configurations installed in the runway touchdown area. Another interesting and important project is an evaluation of a variety of aids that have been developed to provide glide-slope information to permit touchdown in a safe area of the runway. Aids that have been tested to date include:

1. Precision Visual Glide Patch, commonly called the Cumming-Lane System. 2. Westinghouse Tricolor System. 3. British Two-Color System, commonly called the Calvert System. 4. Navy Mirror System. 5. Air Force "Meat Ball" Landing-Aid Light System. — *"Skyways" Feb. '60.*

Fatigue makes you forget
Fatigue makes you careless
Fatigue makes you slow
on the trigger

Rest is like preventive
maintenance, which takes time,
but not as much as a
major repair.
You Rest Up Quicker Than
You Heal Up but
You Can't Store Up Rest.
Get Adequate Rest Every Day!
Get Enough Sleep Every Night!

—Flight Safety Foundation

Sea Gulls and Owls

THE Navy Electronics Laboratory at San Diego recently did some research on the problem of sea gulls roosting on the NEL oceanographic tower—via the biweekly activity report of the Scientific Department, ONR, Pasadena. In response to NEL's query for advice, an ONR, Boston, researcher suggested use of plastic owls. NEL followed the suggestion and plastic owls were placed on the tower. The last word on the subject was to the effect that the beautiful but pesky sea gulls haven't returned in over five weeks.—*"Naval Research Reviews"*

Ear Plugs—Easy Does It

RECENTLY we had a mechanic report that, when removing an ear plug he "felt a loud plop" accompanied by intense pain. Examination showed a perforated ear drum and an infection of the ear. The mechanic states that it was his custom to wet the plugs with saliva before inserting them. He had experienced the popping sound when removing them before, but had not had any after effects.

The Medical Department advises that wetting ear plugs or the presence of an excessive amount of wax in an ear can cause such a tight fit that sudden removal can cause a vacuum, with results similar to those described.

Slow and gentle removal of the plug from the ear canal at all times is recommended. Easy does it.— *FSF, Inc. "Mechanic's Bul."*

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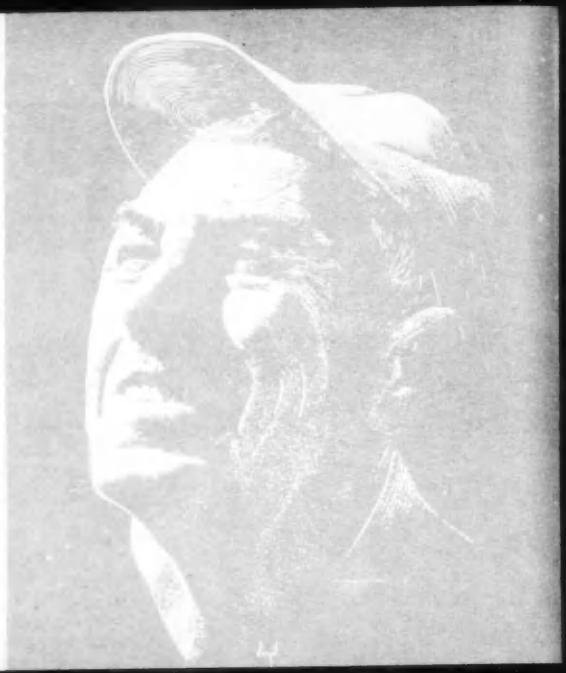
good
maintenance
begins
with a
good
approach



The sole purpose of Aviation Safety is to save lives and equipment so that we may successfully accomplish our assigned missions. The awards that may be bestowed for safe practice should not be confused with rewards derived from it, but should be kept in their proper perspective.

FOD

Problem: **Most Foreign Object Damage to jet engines begins with Pilot/Mechanic hardware induced during preflight or maintenance.**

Solution: **FOD-proofing must begin with Pilots and mechanics positively controlling their hardware.**

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